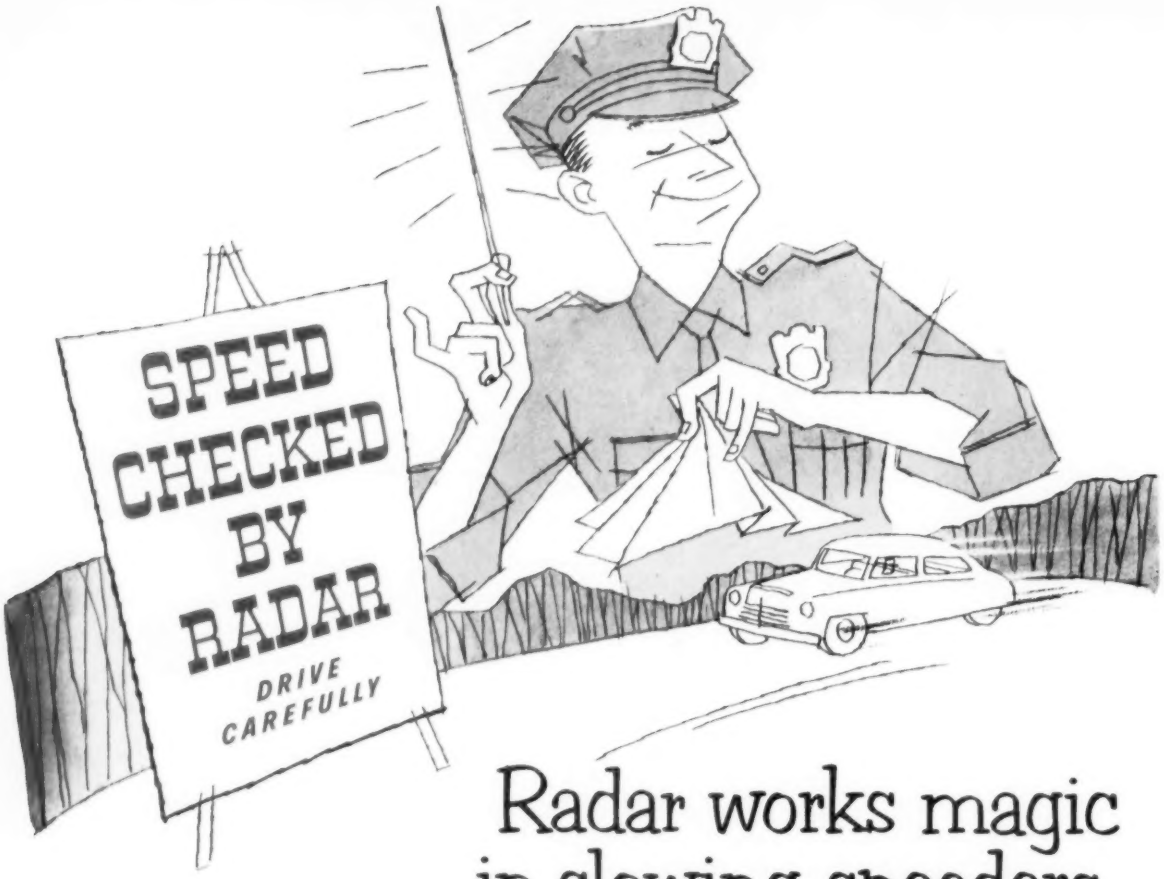
PUBLIC WORKS

June 1954

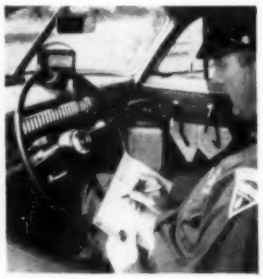
CITY, COUNTY AND STATE

Frederick W. Crane, General Manager of the Buffalo Sewer Authority, and a Director of the American Public Works Assn. More on page 22.



Radar works magic in slowing speeders...

The Electro-Matic® Model S-2 Radar Speed Meter operated by law enforcement officers provides a safe, positive means of detecting and controlling speeders. Violators soon discover the magic of radar equipment accurately indicates their excessive speed to the police-operator. Enforcement officials find many advantages in using the Speed Meter: Checks far more vehicles than a cruiser car • Eliminates hazards to pursuing officers and to motorists • Effective day and night and in all weather • Psychological deterrent to would-be speeders • Portable for spot checking • Ideal for investigating complaints of neighborhood speeding • Either one man or two-man usage of the Speed Meter can be employed. FOR FULL DETAILS WRITE FOR BULLETIN R-102.



TRAFFIC ACTUATED ®

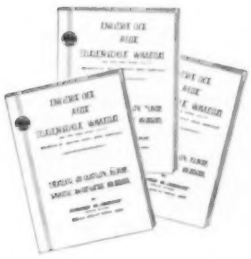
AUTOMATIC SIGNAL
DIVISION
EASTERN INDUSTRIES, INC.
NORWALK • CONNECTICUT
In Canada, Northern Electric Co., Ltd., Belleville, Ontario

ACCELERATED SLUDGE DIGESTION NOW A FACT

at the Columbus, Ohio Sewage Treatment Works

CRP

CATALYTIC REDUCTION PROCESS



Reprints of the paper by Professor P. F. Morgan on the development of this Process, and a paper by Mr. James H. Blodgett on the Columbus installation are available on request.

The Catalytic Reduction Process* has been installed at the Columbus, Ohio Sewage Treatment Works. The Process has increased digester capacity. For treatment plant expansion in the near future, it will not be necessary to build additional digesters. The Catalytic Reduction Process applied to one 70′ tank at the Columbus plant increased total digester capacity by the equivalent of three tanks.

This is possible because the Process completes biological sludge digestion with solids loading rates three to four times conventional past practice. The tank operating under the Process produces the required reduction of volatile solids, normal gas production, and a readily driable odorless sludge.

Originating in 1946, the Process was developed, tested and verified over six years on both laboratory and pilot plant scale. The results obtained in the pilot plant operation have been proven in full scale plant operation at the Columbus, Ohio installation.

The Catalytic Reduction Process is now available for consideration by consulting engineers for application on plants under design and for plants requiring expansion.

**The only proven Process for accelerating biological digestion. (Patents applied for.)*

The Catalytic Reduction Process is offered through the Catalytic Reduction Co., Inc. a subsidiary of the Chicago Pump Company.

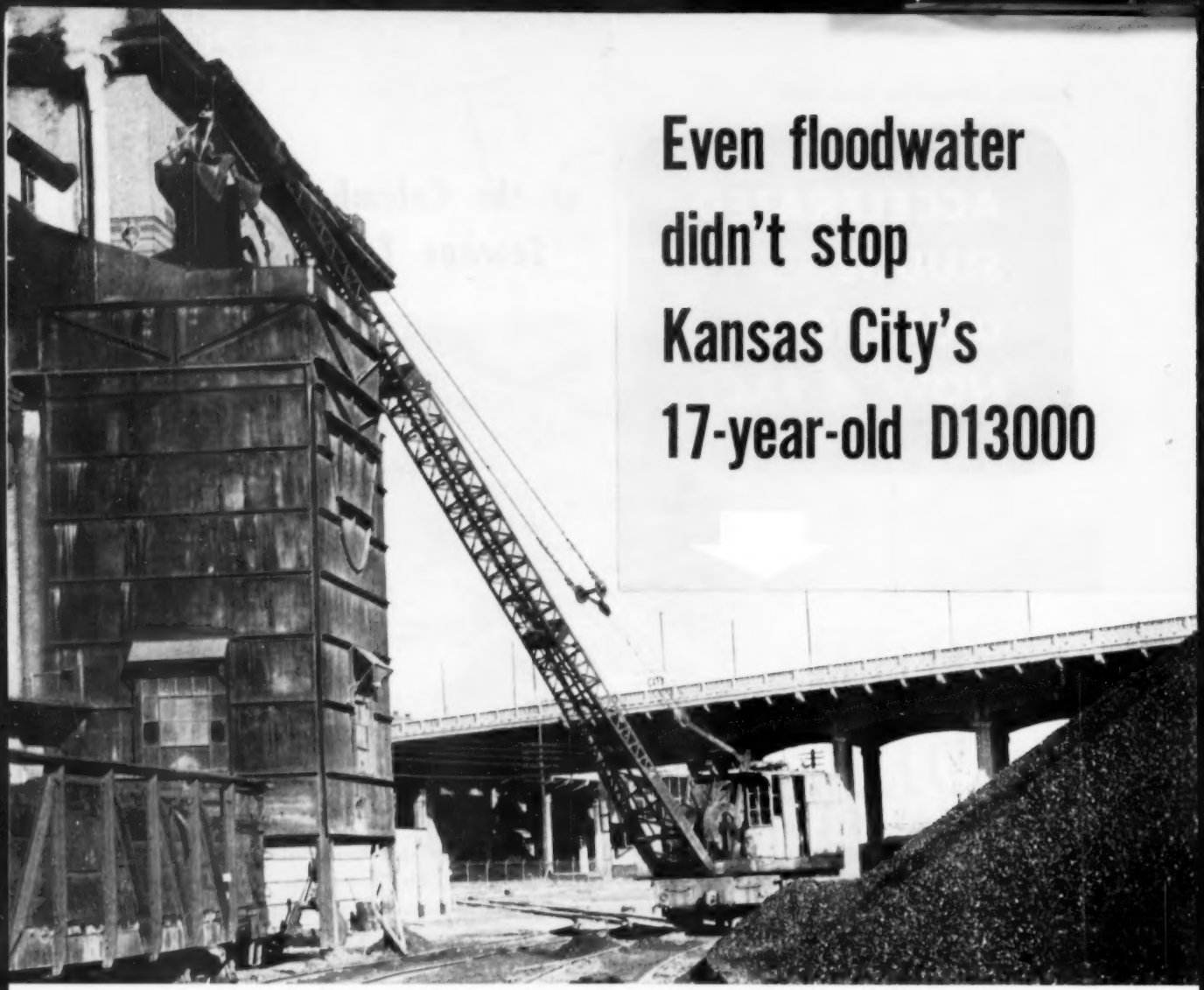
CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

622 DIVERSEY PARKWAY — **CHICAGO 14, ILLINOIS**

Flush Eliminator, Screw Pump, Plunger, Horizontal and Vertical Non-Clog, Water Seal Pumping Units, Samplers

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.



Even floodwater didn't stop Kansas City's 17-year-old D13000

In Kansas City, Missouri, an important part of the water system is a 17-year-old Cat® D13000 Diesel Engine that emerged from floodwater ready for action.

This sturdy Caterpillar Engine powers an Orton locomotive crane with a one-yard clamshell. The coal unloaded from gondolas is used to generate steam for pumping 90 per cent of Kansas City's water supply — 70,000,000 gallons daily. When it isn't unloading coal at the rate of 40 tons hourly, this Caterpillar-powered crane is switching cars.

James L. Moore, superintendent of steam pumping, describes this engine's remarkable 17-year record:

"It was overhauled in 1945 at a cost of $530. It was under floodwaters in 1951 and after a cleanup was back in action. It still has its original crankshaft in it."

Mr. Moore's last statement speaks volumes about the durability and long life of Caterpillar Diesel Engines. That crankshaft and all other parts were designed and built for years of hard work. Effective seals and filters keep dirt and abrasives from moving parts, holding engine wear to a minimum.

It's this extra care and attention to detail that have made Caterpillar Engines favorites among economy-conscious municipalities. With Cat Diesels, wasteful down time and costly repairs are avoided.

Your Caterpillar Dealer has a wide selection of engines and electric sets up to 500 HP and 315 KW. See him soon. And remember, when you repower or buy new equipment, specify Caterpillar Diesel Engines.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR®

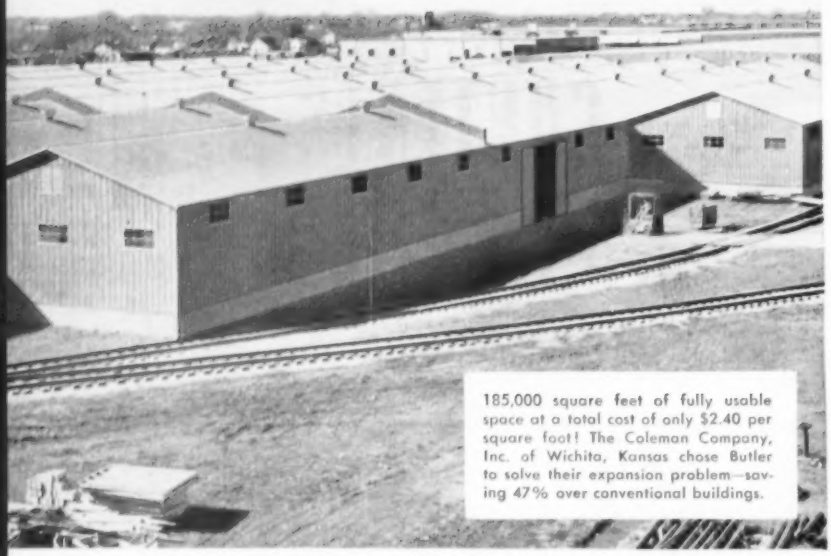
SPECIFY CAT POWER FOR COST-SAVING PERFORMANCE

PUBLIC WORKS MAGAZINE

CONTENTS

June, 1954 **Vol. 85, No. 6**

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES



185,000 square feet of fully usable space at a total cost of only $2.40 per square foot! The Coleman Company, Inc. of Wichita, Kansas chose Butler to solve their expansion problem—saving 47% over conventional buildings.

Build for life...build for less with BUTLER steel buildings

Engineered to modern management needs in a rapidly changing economy—that's why Butler steel buildings give you *more* than mere shelter and workspace. They are a *new* profit-tool for management! Butler's versatile buildings can be modified to new purposes, new installations, new plant layouts—or moved to new locations—quickly and inexpensively. They can be erected in one-half the time required for commonly used materials. Butler buildings equal or exceed conventional structures—in unobstructed clear-span interiors—in snug weather-tight protection for extremes of heat and cold—in appealing good looks, and unbeatable economy!

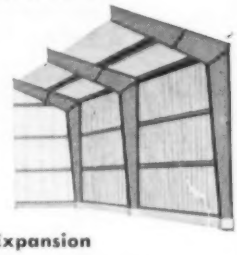
Yes, you build better *for less.* The Coleman Company economy story illustrated above is a common experience of Butler customers. Savings on the original financing—or investment of reserves, will make a real difference in the profit position of your organization from the very start. Lower maintenance costs and depreciation of Butler galvanized or aluminum sheeting will pay you an extra yearly dividend.

Butler buildings are an important part of your profit picture. Write today for full details and the name of your nearest Butler dealer.

Here is why BUTLER is a better buy

Every Foot of Floor Space is Usable

There are no interior posts or columns to waste space and create work-slowing "bottlenecks." Rigid-frame construction also shrinks maintenance costs . . . extends building life.



Fast Erection . . . Easy Expansion

Precision-punched and dimensioned bolt holes speed erection—simplify expansion or dismantling and moving. Galvanized bolts, with Neoprene rubber washers, lock deep-corrugated sheets firmly to the sturdy frame.

Weatherproof Protection

The one-piece, die-formed roof ridge eliminates ridge roll—helps to make the building leakproof and weather-tight.

Triple-Strength Corrugated Sheets

Butler sheeting with deep-formed corrugations on 12-inch centers, is three times as strong as ordinary corrugated sheets. Overlapping corrugations bolt tightly together for maximum strength and weather protection. Your choice of steel or aluminum sheeting.

Attractive Curved Eaves

The neat, die-formed eaves—which bolt to the roof sheets—add to the appearance of Butler steel buildings...increase the strength of the eaves . . . help insure weather-tightness.

Weather-sealed Windows and Base

Where corrugated sheets meet windows or the foundation, they are tightly crimped for a snug fit that keeps out snow, moisture and rodents.

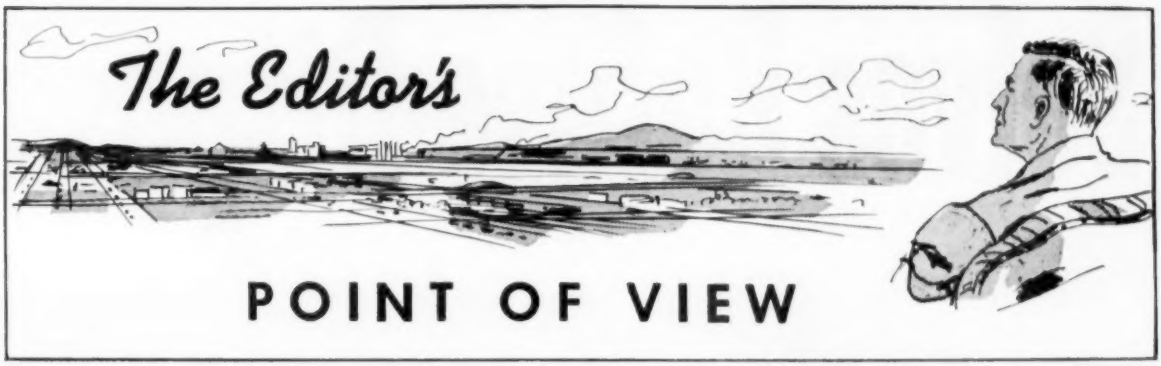
BUTLER STEEL PRODUCTS

BUTLER MANUFACTURING COMPANY

7321 East 13th Street, Kansas City 26, Missouri
921A Sixth Avenue, S. E., Minneapolis 14, Minnesota
1021 Avenue W, Ensley, Birmingham 8, Alabama
Dept. 21A, Richmond, California

Manufacturers of Oil Equipment • Steel Buildings • Farm Equipment • Cleaners Equipment • Special Products

Factories located at Kansas City, Mo. • Birmingham, Ala. • Richmond, Calif. • Galesburg, Ill. • Minneapolis, Minn.



But Men Are Still More Important than Machines or Equipment

IN the fine new booklet issued by the Public Health Service on the occasion of the dedication of the new sanitary engineering center at Cincinnati, there is brief reference to the beginnings of the work done there, the success of which, in fact, was responsible for the fine building now available. But there was not a mention of the men who had the ideas, the energy and the knowledge that made this new laboratory p ssible, and gave it the background so essential to its future value. It seems to us that the names of Phelps, Hoskins, Streeter, Crohurst and the others who had such a large part in this splendid heritage should have been prominent in any story, no matter how brief. It is the mind and the spirit, and not the physical equipment, which makes this or any other institution great in its contributions to the national welfare.

Some States are Forgetting the Importance of Detour Signing

WE thought that all highway departments now realized the necessity for adequate marking on detours. However, we recently traversed a detour on a state highway where the detour was marked with only a few small white painted signs placed right on the turns with no advance notice. We missed a couple. By contrast, an adjoining state had an extensive detour marked with numerous yellow signs that were well placed. Certainly the good will created for this department is well worth the cost of proper and adequate detour marking.

Finding More Ways to Utilize Money-Saving Equipment

OUR cities and counties are gradually learning that the pick and the shovel are the most expensive tools they can own; and that there are as many places in public works engineering, as there are in industry, where labor-saving and money-saving equipment can be used. After all, about the only difference between an industry and a city is that the former may cover five acres and the latter five square miles. So the City Engineer must modify his procedures so that he carries on efficient operations over some 3,000 acres instead of over five. The county engineer may have a hundred times as much area as the city, or even more; but his problem remains largely one of organization and mechanization

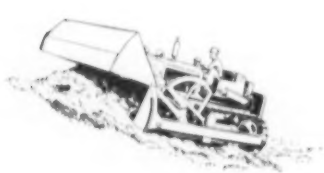
Over the past year we have given special attention to money-saving uses of equipment, and we shall continue to do so in the future. We do not believe that our cities and our counties can meet present-day needs without thorough modernization of methods and equipment, no matter whether those needs be street patching, road maintenance, water works maintenance and extensions, sewerage and sewage treatment, refuse collection and disposal or any other of the many problems that our public works engineers must solve in their service to the public.

To Ease Some of the Burdens of our Counties and Townships

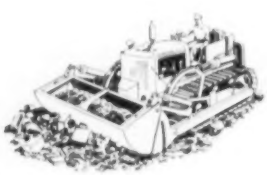
BURDENS are now being placed on our counties and townships—or equivalent political subdivisions—for which they are not prepared either mentally or legally, in most states. We refer particularly to the development of thickly settled areas outside city limits, with the attendant problems of sewerage and refuse collection and disposal, adequate highways and, in some cases, water supply. While the inadequacies of highway service and the high cost of using poor roads are annoying and costly, the matters of water, sewerage and refuse can vitally affect health. It is true that there has been progress during the past two or three years, but many states need better legal procedures for controlling conditions in these extra-urban areas. We hope that an increasing number of state health departments will be prepared to go before the state legislatures with sound programs for the amelioration of these conditions and for the control of new developments, more of which are sure to come. If there are still any state health authorities who will react to this suggestion with "Who, me?" we sincerely hope it will be the medical folks of the department and not the engineers.

Solves Refuse-Disposal

AFTER REFUSE IS SPREAD and compacted by the INTERNATIONAL DROTT unit, the "one man sanitation squad" will cover the area with a layer of earth, converting rocky, worthless land into valuable commercial or agricultural property.



1. Prepares the site



2. Crushes and compacts refuse

3. Transports and spreads earth cover

4. Grades and levels finished area

Problem for Waterville

Bullclam Shovel Method of Sanitary Fill Provides Answer to Refuse Disposal Question at Waterville, Maine

The odor of burning garbage from the open dump is gone forever, much to the satisfaction of the citizens of Waterville, Maine.

Recently, the city bought an INTERNATIONAL TD-14A crawler tractor equipped with a DROTT BULLCLAM shovel.

Closing the old city dump, Waterville started the Bullclam Shovel Method of Sanitary Fill for garbage disposal at a run-down farm that had been purchased by the city. As refuse is dumped, it is spread and compacted by the INTERNATIONAL-DROTT unit. At the close of each day, the "one man sanitation squad" covers the refuse with a layer of earth. No odor, no rats, no flies, no windblown waste.

Now, according to Dr. Arthur Daviau, City Health Officer, "Instead of burning rubbish with no return, we're profiting by using it to reclaim otherwise worthless land."

And when fill operations are completed at the farm site, Waterville city officials are talking about using the INTERNATIONAL-DROTT BULLCLAM Shovel Method of Sanitary Fill to turn an abandoned gravel pit into a playground.

Ask your INTERNATIONAL Industrial distributor for details on the INTERNATIONAL-DROTT BULLCLAM Shovel Method of garbage disposal.

Or write to:

DROTT MANUFACTURING COMPANY, MILWAUKEE 8, WISCONSIN
INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

Defender of Community Health

BULLCLAM BY

DROTT

INTERNATIONAL HARVESTER

POWER BY

INTERNATIONAL

POWER THAT PAYS

Thousands use our Readers' Service card to keep up to date . . . do you?

Dempster-Diggster bucket GETS A FULL LOAD WITH EVERY STROKE!

The hydraulic crowd and hoist operation of the new Dempster-Diggster GRD-101 gives you big shovel advantages in front end loading and excavation work. As shown in the at-work photos at right, here's what happens: Dempster-Diggster moves into material with shovel lowered against front of frame. No wheel traction is used to get excavation power. The hydraulic crowd and hoist moves bucket out and up following contour of material—getting a full bucket with every stroke . . . reducing loading time and idle truck time, thus getting the job done faster!

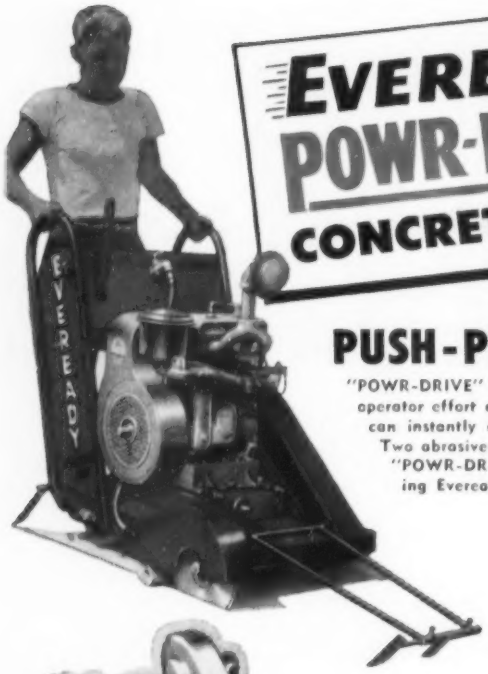
When you put your Dempster-Diggster into operation, one of the first things you will find is that your entire operation must be geared to a faster pace. This means greater efficiency of equipment and manpower—more profit to you!

Write us asking for Folder No. 3116 giving you complete information on the features of the Dempster-Diggster, including TRUCK-SPEED MOBILITY TO AND FROM JOBS . . . AUTOMATIC BUCKET TRIP . . . MAXIMUM DUMPING AND DIGGING HEIGHT . . . MINIMUM TURNING RADIUS . . . THE SHOVEL WITH TORQUE CONVERTER . . . HYDRAULIC STEERING, etc. Manufactured by Dempster Brothers, Inc.

In photo below camera catches Dempster-Diggster ready to back off and move up to a truck for loading.

DEMPSTER DIGGSTER

DEMPSTER BROTHERS, 964 Dempster Bldg., Knoxville 17, Tennessee



EVEREADY POWR-DRIVE CONCRETE SAW

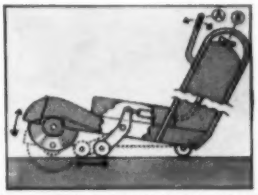
Ask Your EVEREADY Dealer for the Most Complete Line of Masonry and Concrete Cutting Equipment

We've taken the PUSH-PULL Out of Concrete Sawing

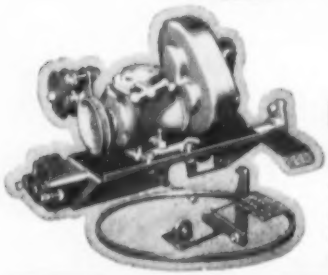
"POWR-DRIVE" smoothly drives saw forward at your controlled speed . . . saves operator effort and increases cutting footage per day. With "POWR-DRIVE" you can instantly regulate the cutting speed to your various cutting requirements. Two abrasive-coated wheels act as a friction drive in contact with both rear saw wheels. "POWR-DRIVE" is engaged or disengaged by a convenient foot lever control. See the amazing Eveready "POWR-DRIVE" Concrete Saw at your local Eveready Dealer.

PATENTED EVEREADY FEATURES

Shown at the right are three exclusive features that make EVEREADY the fastest, most efficient concrete and asphalt cutting saw. Other features are: Dashboard controls for greater ease in operation and maneuvering; blade depth control that permits sawing to a specified depth.

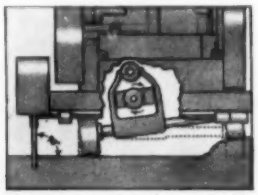


Two easy strokes of Hydra-Eze Handle (A) and hydraulic power lifts blade fast —straight out of cut. Quarter turn of Hydra-Eze Blade Release Lever (B) and hydraulic power feeds blade gently, smoothly into material.



BUY COMPLETE OR ADD THE *NEW* EVEREADY POWR-DRIVE KIT LATER

The "POWR-DRIVE" Kit comes completely assembled . . . only four holes—four bolts are needed to install the kit on any Eveready Concrete Saw. "POWR-DRIVE" Kits are sold only by authorized Eveready Dealers.



On rough or uneven surfaces—the blade on an EVEREADY Concrete Saw always cuts in a perfect, true, vertical plane. TRI-MATIC BLADE ALIGNMENT prevents binding, twisting, or tilting of the blade as the saw moves over uneven or broken surfaces.

"POWR-DRIVE" cuts MORE Concrete Every Hour . . . Cuts Costs on Every Job! and EVEREADY'S "PROVEN QUALITY" is Your Guarantee for "PROVEN RESULTS"!

EVEREADY Concrete Blades

EVEREADY RED-I-CUT DIAMOND BLADES

For faster cutting — PLUS maximum blade life — regardless of the type Concrete or Asphalt cut. Red-I-Cut Blades fit EVERY make and model saw.

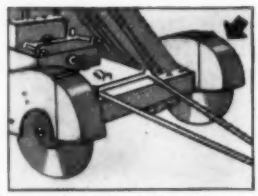
EVEREADY TUFFIE CONCRETE BLADES

Cut Green Concrete at ONE-THIRD the cost! The NEW "TUFFIE" Abrasive Blade, reinforced with steel wire-mesh, cuts new highway slab—ALL "Green Concrete" slab—at unbelievable savings in labor and blade cost. Your dealer has it NOW!

EVEREADY BRIKSAW FOR MASONRY CUTTING

FREE BOOK

FREE BOOK on Masonry cutting . . . requested by more than 18,000 . . . will be sent without obligation . . . or ask your dealer.



Place blade on either side of saw to cut in corners and confined areas. Blade guard, water hose, and front guide wheel marker assembly are all interchangeable.

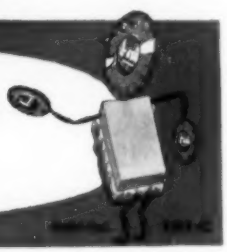
EVEREADY DEALERS . . .

in Most Principal Cities in the United States and Canada

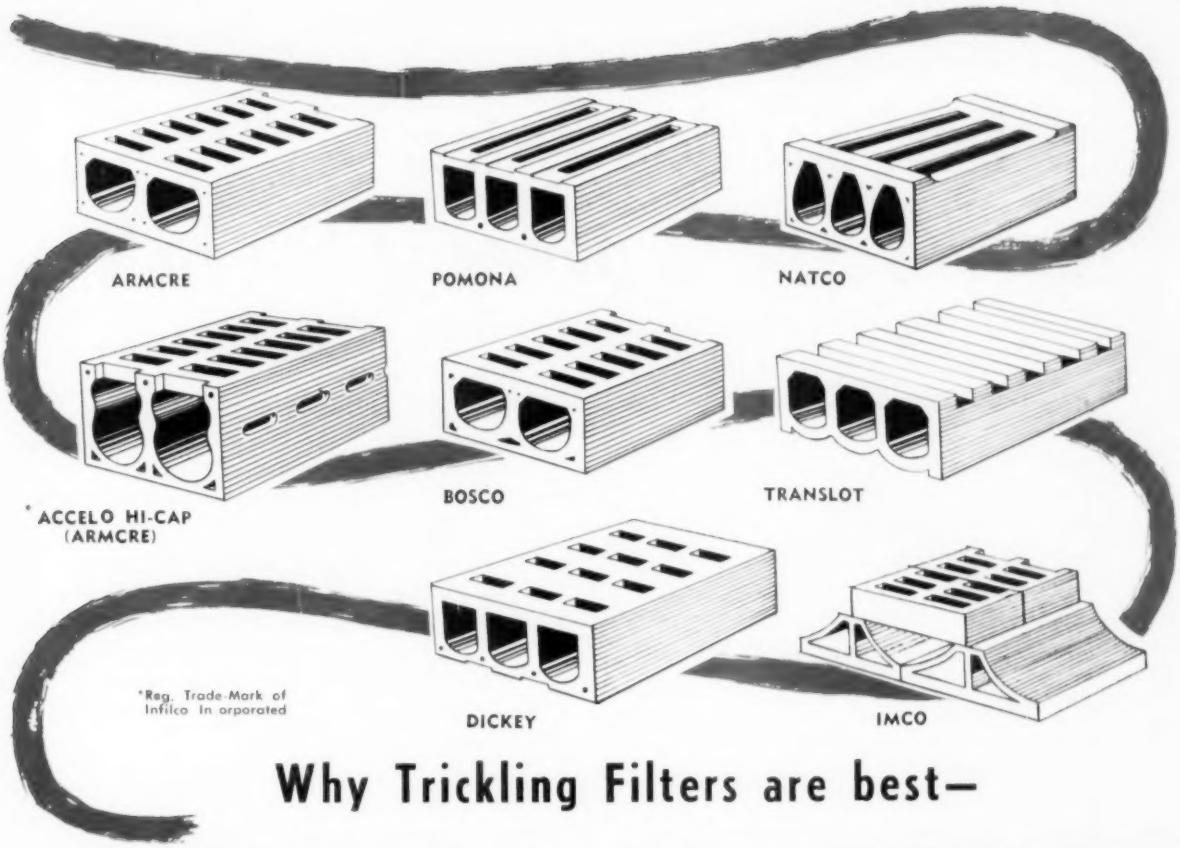
Write for the Name of Your Nearest Dealer.

EVEREADY BRIKSAW CO. ● 1509 S. MICHIGAN BLVD.

CHICAGO 5L, ILL.



Get full details of this month's products . . . mail your Readers' Service card today.



*Reg. Trade-Mark of Infilco Incorporated

Why Trickling Filters are best—

OVERLOAD IS NO PROBLEM

Yeomans Brothers' "Aero-Filter" System plant at Plant City, Florida.

Trickling Filters will carry overloads. Those temporary shock loads that come to all plants are no problem for trickling filters. They take them in their stride. If you are using a trickling filter in your plant often times that new or expanded industry will pose no problem at all. The best and most efficient trickling filters are built with vitrified clay TFFI underdrains.

There are still a limited number of copies of the 1954 Handbook of Trickling Filters available. This is a new revised and enlarged edition. If you don't have a copy write to any member of the Institute listed below and a copy will be sent to you without any obligation. Remember—the best trickling filters use vitrified clay filter bottom blocks.

TFFI

TRICKLING FILTER FLOOR INSTITUTE

Pomona Terra-Cotta Co.
Pomona, N. C.

W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.

Texas Vitrified Pipe Co.
Mineral Wells, Tex.

Natco Corporation
Pittsburgh 22, Pa.

Ayer-McCarel Clay Co., Inc.,
Brazil, Ind.

Bowerston Shale Co.
Bowerston, Ohio

Industrial Materials Co.
Philadelphia 34, Pa.

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

Westinghouse Metal-Clad Switchgear is mounted in a single line, over 100 feet long. This permits maintenance of circuit breakers and transfer of loads from front of switchboard, without power loss at any point.

People, Ideas and Events

BY "DOC" SYMONS

H.T.M.A. — And as you read this, the Seattle Convention of AWWA is a thing of yesterday. Publication schedules being what they are, it will be next month's issue before I can make any comments. Meanwhile let's look over a few other happenings.

★ ★ ★

So Help Me — Now that we are just about to approach the end of the ten year period during which we were going to prove the efficacy (that's a good word) of fluorides for the prevention of tooth decay and what happens—Dr. Albert C. Sobel of Jewish Hospital in Brooklyn predicts that in 20 years tooth decay will be a thing of the past for coming generations, through the control of mineralized tissues, and, if caries do develop, they'll be filled with materials indistinguishable from real teeth.

And just where will that leave all of the dentifrices (ammoniated, chlorophylled, and anti-enzymed) and fluoridation? ? ?

★ ★ ★

Biggest Penny in the World—If you watch CBS Television on Sunday nights and see "You Are There", you'll note that every other week, America's Light and Power Companies keep telling you how much you can get for a penny spent for electric power.

Willing Water® — says, "Shucks, they haven't got anything to brag about. A penny will buy a lot more water than it will electricity.—For a penny you can buy 500 glasses of water, or flush your toilet five times, or take a bath, or water your lawn for 20 minutes. For a cent and a half, you can have about all of the water any one person needs in a single day for all home use, including drinking, cooking, laundering, toilet flushing bathing, etc.

Cheap, isn't it—too darn cheap. If the cost were only 2 cents per person per day instead of 1½ cents, everybody could have better water service by far, than they have now. In this land where we worship the exaggerated, we too often neglect and bemean the inexpensive, forgetting that value is what we should recognize, not cost.

★ ★ ★

Electricity does great things and is a great convenience—but did you ever try to live without water.

★ ★ ★

Wanna Bet?— Last month, I mentioned that I had a bet with Rick Johnson of AWWA that the AWWA Membership would hit 10,000 during July. Since I first made that prediction nearly two years ago, I have carefully plotted the actual monthly membership data as published in JAWWA.

Out of curiosity recently, I tabulated my prediction curve against actual figures. Here's how they go—

Month	*Prediction*	*Actual*
Dec. 1, '53	9850	9775
Jan. 1, '54	9500	9480
Feb. 1, '54	9575	9585
Mar. 1, '54	9675	9686
April 1, '54	9765	?
May 1, '54	9850	?
June 1, '54	9940	?
July 1, '54	10,000	?
Aug. 1, '54	10,060	?

Looks as though I might make it, but since my prediction was that the 10,000 mark would be reached *in* July (I didn't trust my own figures to make it on the nose on July 1), we'll have to wait until the August or Sept. issue to see how near I came to it.

★ ★ ★

Willing Water® — sez: "The historic and picturesque Chattachoochee River, source of Atlanta's water supply, is one of the largest volume

(*Please turn to page* 160)

RECENT TRADE LITERATURE...

Altitude Valves

New 16-page technical bulletin W-4 fully describes G-A Cushioned Altitude Control Valves, which assure accurate water level control in elevated tanks and reservoirs. Featured in this catalog are illustrations, operating sequence, installation arrangements, general instructions, parts lists and dimensions.

Write to Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa.

Surge Relief Valves

8-page Bulletin W-2 contains complete information about G-A Cushioned Surge Relief Valves, which automatically protect water lines against excessive pressures caused by surges in the system. Sectional diagrams and installation arrangements are featured.

Write to Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa.

Pressure Reducing Valves

New 6-page Bulletin W-3 completely describes G-A Cushioned Water Pressure Reducing Valves, which automatically reduce an existing high pressure to a predetermined low pressure. The installation, operation, adjustment, servicing and specifications are fully described.

Write to Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa.

Solenoid-Operated Valves

Bulletin W-7 contains the latest technical data on G-A Cushioned Solenoid-operated Valves, which can be used not only as spray and quenching valves, but also for 1001 uses in almost every industry where remote control operation is desired. Both the all-bronze valves in sizes ½" to 2" and the IBBM valves in sizes 2½" through 36" are fully described.

Write to Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa.

Float Valves

G-A Cushioned Float Valves maintain accurate water level control in elevated tanks, reservoirs, coagulating basins, mixing chambers, etc. They are designed for either cold or hot water service in either the quick-opening or throttling design with integral or remote pilot control. Full technical data is contained in Bulletin W-5.

Write to Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa.

Swing Check Valves

Technical bulletin W-1 describes the G-A Cushioned Swing Check Valves which automatically close to prevent reverse flow on pump shut-down. Design and construction features are shown, along with complete parts list, dimensions and specifications.

Write to Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa.

Flowtrol Valves

Bulletin W-8 contains the latest technical data on G-A Cushioned Flowtrol Valves, which can be used either to replace troublesome gate valves that require frequent manual opening or closing, or in place of diaphragm valves. Available in either angle or globe body design, the Flowtrol Valve can be easily moved to the fully open or tightly closed position by simply moving a small pilot cock.

Write to Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa.

UP FRONT FOR ADEQUATE ROADS

BY
LEO J. RITTER, JR.
New York University

Good News—The new federal-aid act, providing funds for fiscal years 1956 and 1957, was passed and sent to the White House in the middle of April. The compromise bill moved through the Congress with amazing speed, reflecting recognition by the present administration of the importance of the highway problem. The bill provides a total of 966 million dollars per year, by far the largest amount ever authorized for this purpose. Breakdown of the federal-aid portion of the authorization is as follows: Primary system, $315 million; secondary, $210 million; urban, $175 million; and Interstate, $175 million. The bill increases funds available for the Interstate Highway System very substantially, since the current program carries only $25 million for this purpose. This reflects the concern which is felt in many quarters over the slow progress being made in improvement of this important mileage. Development of the Interstate System will be accelerated in many states by a new aspect of the law, which provides that one-half the amount available will be apportioned in the ratio which the population of each state bears to the total population of all the states, provided that no state receives less than ¾% of $87.5 million. The bill also provides for the transfer of up to 10 per cent of funds between the primary, secondary, and urban systems. The bill continues to provide authority for the expenditure of certain funds for highway research, including studies of desirable weight-size standards for vehicles using the public highways. Also, the Commissioner of Public Roads is to undertake a study of all possible phases of highway financing. Long overdue, this increased federal-aid program may provide an example for all governmental units to follow in making additional money available for highway purposes.

Words of Wisdom—George Sokolsky of King Features Syndicate recently quoted P. W. Litchfield, Chairman of the Board of Goodyear Tire and Rubber Company, as follows: "We need to organize at the local level. Let's go after an adequate cure of the bottlenecks we know about through our own personal observation. Let's concentrate our efforts on getting roads built and bridges and streets widened in our own neighborhoods, in our own cities, in our own states." Makes sense, doesn't it?

County Planning—A recent issue of *Pacific Road Builder and Engineering Review* reports on an application of the sufficiency rating system to local roads in Kings County, California. Work involved in developing a system by which each section of road in the county can be rated as to its adequacy includes a road inventory, traffic surveys, selection of design standards, and the assignment of a numerical rating. The numerical rating assigned to each section of road is based upon its geometric design, physical condition, safety rating, and service rating (route classification, areas served, function of the road, etc.). When complete, the numerical ratings will be used to determine priority of improvement and to develop a five-year construction program to meet the needs of the county road system. Work is under the direction of Howard Carlson, county road commissioner.

Around and About—Over the Easter holidays, your truly had the chance to move around a little. Spent three days in the vicinity of Chicago, but not in the city. One day we were in Milwaukee, home of beer and Braves. Didn't do much motoring, primarily moving about by air. Was again impressed by the quantity, and quality, of concrete (Portland cement, that is) roads in northern Illinois and southern Wisconsin. Also, the four-way stop signs at so many rural road inter-

(Please turn to page 136)

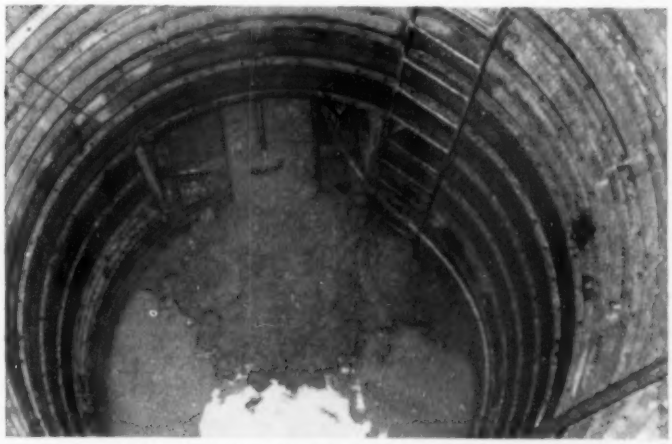
Tunnel helps clean-up job on Ohio River

Cooperating in the regional clean-up of the Ohio River, the city of Charleston, West Virginia, cut costs on a big intercepter sewer project by tunneling the job with Armco Liner Plates.

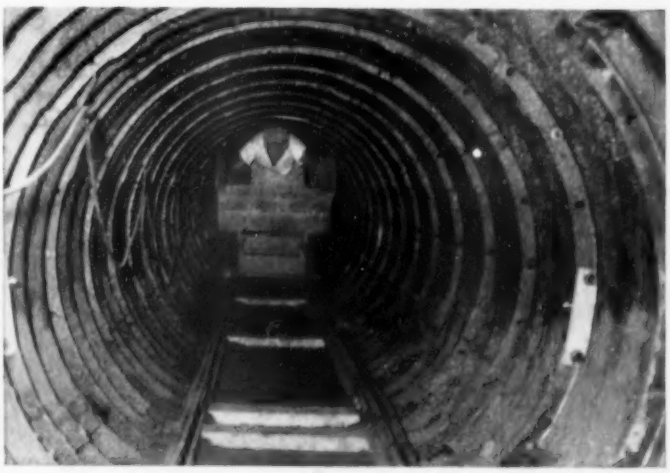
Sewage discharged into the Kanawha River will be processed through a sewage treatment plant that is part of the clean-up project. One of the first problems was that of installing intercepter sewers about 25 feet deep under two heavily traveled streets. Open cutting would have torn up sidewalks and pavements, disrupted traffic and business. Economy and convenience were prime considerations in tunneling with Armco Liner Plates. Tunnels were driven in both directions from shafts sunk every 400 feet. The tunnel required almost 4,000 feet of 12-gage, 48-inch diameter Armco Liner Plates. As the tunnel was completed the Armco Liner Plate used in the shafts was salvaged for reuse.

You, too, may benefit by using Armco Liner Plates as a solution to your own sewer problems. They are ideal for tunnels, shafts, caissons, conduits, underpasses, aggregate bins and for lining existing failing structures. Write for details. Armco Drainage & Metal Products, Inc., 1894 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

Inconspicuous shaft eliminates traffic congestion and torn-up pavements.



Looking down Armco Liner Plate shaft to mouth of tunnel.



Dump cart on rails hauls out dirt as Armco Plates are assembled.

ARMCO LINER PLATES

ARMCO

QUESTION*

How much more material is there in a Three-Inch-Higher Windrow . . . 9% . . . 18% . . . 31% . . . ?

Cross section of an average, 21-inch high windrow . . . the area (width x height ÷ 2) is 614 sq in.

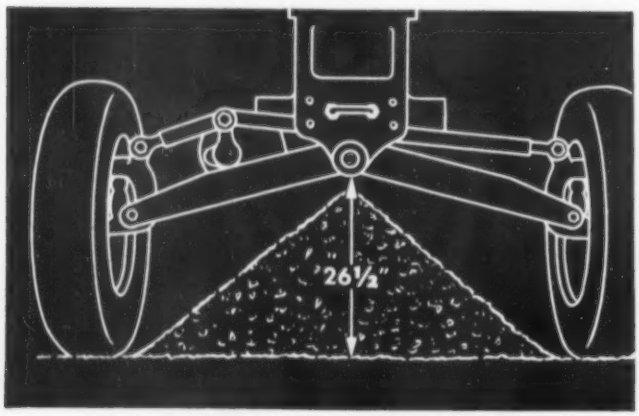
Now increase the height of the windrow by 3 in. The cross-section area now equals 804 sq in.

The difference 190 sq in, over 30 percent more area, which means over 30 *percent more yardage.*

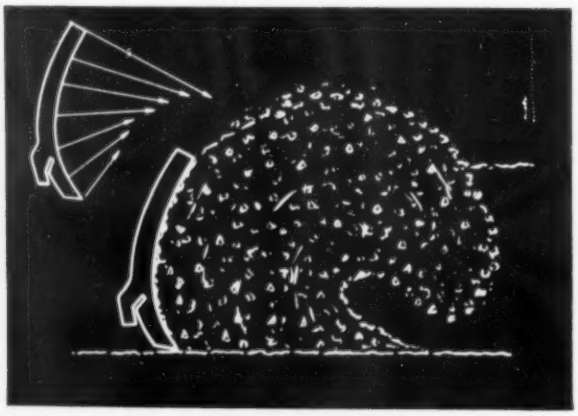
*Only a Combination of Advanced Design Features Lets a Motor Grader Handle Big Loads Fast

To take full advantage of even a *three-inch* difference in windrow height (as explained above) a heavy-duty motor grader needs new design and performance characteristics from front to rear . . . and from the top of the main frame to the bottom of the blade. No single feature can give you the increased work capacity that is so essential on road construction, maintenance and oil-mix jobs.

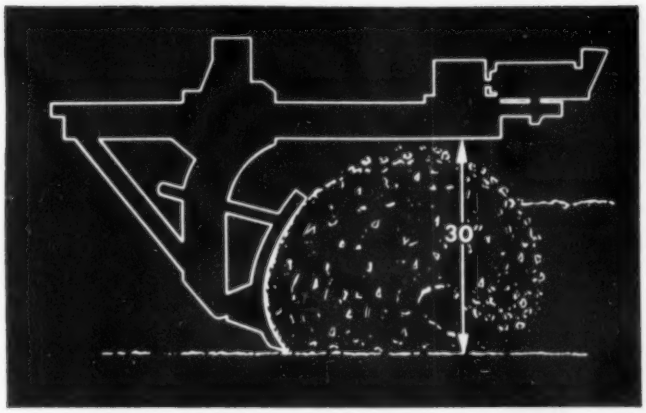
Now let's analyze the Allis-Chalmers 104-brake-horsepower AD-40 to see how it measures up to these stiff requirements.



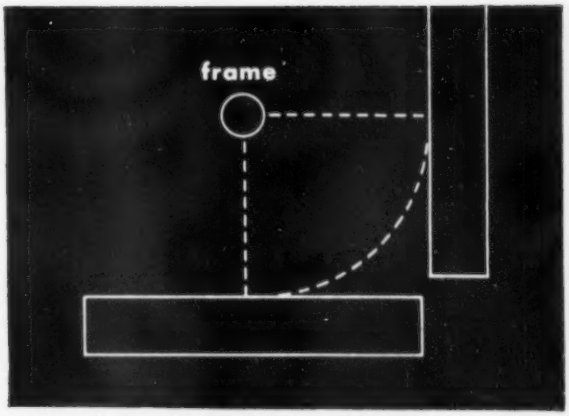
1 **A high-arch front axle** to straddle big windrows . . . take advantage of that 3-inch difference and let big loads pass through to the blade.



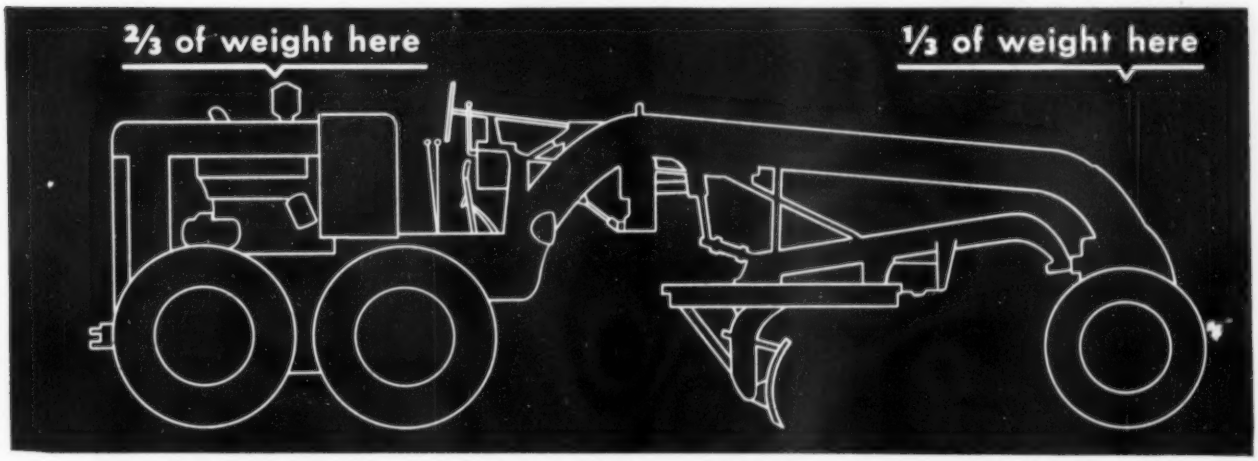
2 **A rolling-action moldboard** . . . to insure a "live" load that rolls freely off the blade . . . moves the load faster and takes full advantage of engine power.



3 **Ample throat clearance** . . . to handle 30 percent bigger loads without disturbing free, rolling action . . . and without jamming dirt, oil-mix or any other material against the circle.

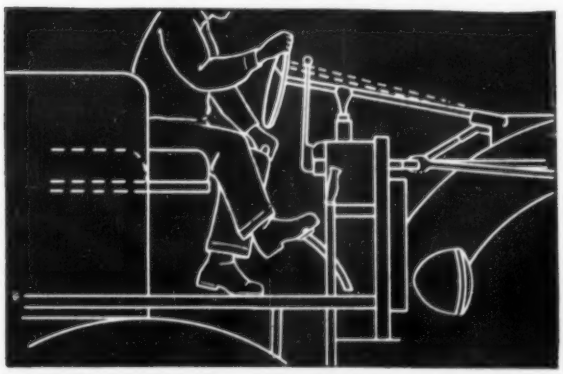


4 **Full blade freedom** . . . the exclusive tubular frame and a long tubular drawbar insure full blading effectiveness on the road, in the ditch or on the slope.



5 **Blading accuracy** is essential. A long wheel base, the tubular frame . . . and lift-cases located directly over the circle, provide smooth, accurate finishing.

6 **Balanced power, weight and traction** . . . a heavy-duty engine and *two-thirds* of the weight concentrated on tandem-drive rear wheels provide the best in traction, positive blade pressure and steer-ability.



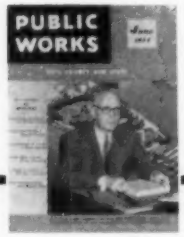
7 **Easy control and visibility** — A big platform with plenty of leg room . . . adjustable seat and steering wheel . . . power steering will assure working ease. Single member frame, low control board and tapered platform corners provide "pilot-house" visibility.

This design, that combines working advantages every owner needs and wants, exists in only one motor grader . . . the Allis-Chalmers AD-40. *That's a fact* . . . a fact your Allis-Chalmers dealer will be glad to prove to you. Ask him to show you how the AD-40 gives you the *differences* that mean more work done . . . by a demonstration under on-the-job conditions.

ALLIS·CHALMERS
TRACTOR DIVISION · MILWAUKEE 1, U. S. A.

AD-40 Motor Grader
104 brake hp • Weight — 23,000 lb

Now's the time to mail this month's Readers' Service card.



LEADERS IN PUBLIC WORKS

★

Frederick W. Crane has had a long and distinguished career in public works. He is now General Manager of the Buffalo Sewer Authority; previous to that was Commissioner of Public Works of Buffalo, and before that he was Buffalo's city engineer. He started work with the City in 1923, four years after his graduation from Cornell with a CE degree. His service as Commissioner of Public Works of buffalo ended the first of this year. In that capacity he was responsible for the Divisions of Engineering and Buildings and Water, and the Bureau of Smoke Abatement; and he was also Examiner of Steam Boilers and Stationary Engineers.

He has been active in the American Public Works Association and is now a member of its Board of Directors. Until the start of this year, he served as president of the Buffalo Section ASCE. Other society memberships include AWWA, ARBA, NSPE and local groups. He is married and he and Mrs. Crane have two married daughters, both of whom live in Chicago, and four grandchildren. He is interested in books and has a library of more than 500 volumes, many of which are first editions, and many autographed by authors. These and his membership in the American Numismatic Society are his hobbies. He has also been active in the Masons, and among his many offices has been Deputy District Grand Master of the Grand Lodge of the State of New York.

NORTH DAKOTA LANDFILL

There is not much more that can be said about our sanitary landfill in addition to what was published in PUBLIC WORKS for May, 1952. The last two winters here in our section of North Dakota have been very mild and we have had no problems whatsoever with respect to the operation of our sanitary landfill. We have, however, operated during severe winters and find that this operation works very well in the colder climates. We are thoroughly convinced that this method of garbage disposal is the answer to our problem as it is both efficient and economical.

Edward J. Booth,
City Engineer,
Bismarck, N. D.

THAT ORDER OF THE BOAR

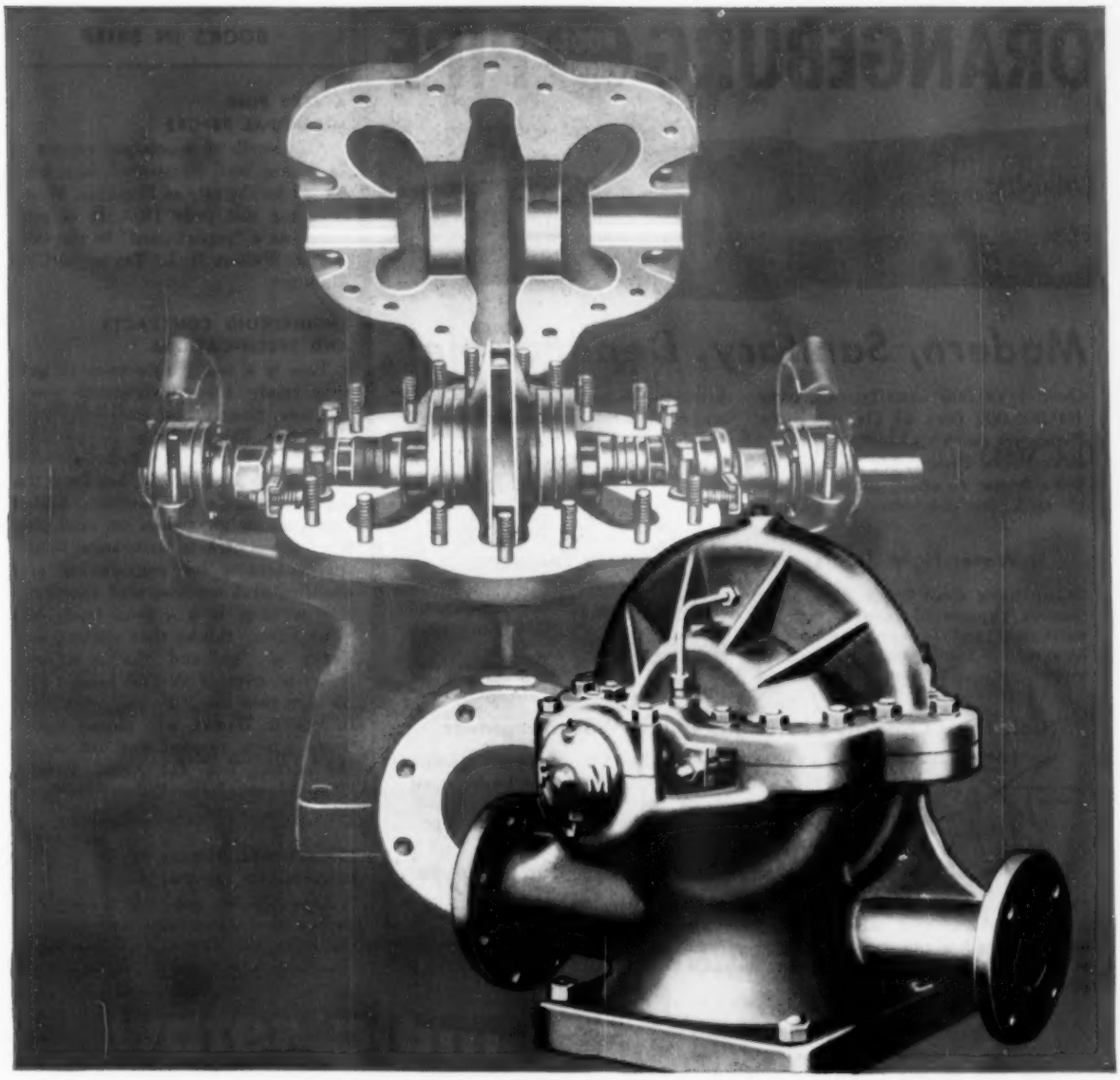
Tentative arrangements have been completed for the Boar Dinner, to be held at the Netherlands Plaza Hotel, Cincinnati, on Oct. 12, Tuesday evening, in connection with the FISWA meeting. "Pete" Wisely is cooperating in this important event and "Shorty" Stilson will assist with the dinner (and the initiation). Tell all the Boars and Shoats to contact one of us.

J. J. Gilbert,
Engineer in Charge,
San. Engrg. Equipment,
Link-Belt Co.,
Colmar, Pa.

ARTICLES HELPED

I want to thank you personally for using the various articles I have submitted (of course the extra cash comes in handy, too) as those articles helped me secure this new position. Thus, I not only received pay for the articles, but also received a substantial salary increase in my new position as city manager here.

A City Manager



out of the mouth of a pump...

Suppose a pump could "spill its works" . . . tell you how it was made . . . speak of the design, material, workmanship that went into its being . . . then you could know . . . and buy with confidence.

Because after all, pumps do look very much alike. How, then, to tell which make is best for you. *Reputation* is one way, *performance* another.

And, on both counts, Fairbanks-Morse pumps stand out. Don't take our word for it. Check with Fairbanks-Morse users. We'll stand by their verdict. For Fairbanks-Morse has only one standard . . . *quality* . . . the quality that means dependability, service, low maintenance, all those important points that you want in the pumps you buy.

To get these advantages in your pumps, rely on the world's largest manufacturer of a complete pump line. See your nearest Fairbanks-Morse Branch, pump dealer, or write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

FAIRBANKS-MORSE

a name worth remembering when you want the best

PUMPS • SCALES • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • RAIL CARS • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS

BOOKS IN BRIEF

A VERY FINE MUNICIPAL REPORT

An excellent municipal report of 24 pages, well illustrated, has been issued by the city of Hopkins, Minn., covering the year 1953. It is prepared as a "report card" to the taxpayer. Walton R. L. Taylor is City Manager.

ENGINEERING CONTRACTS AND SPECIFICATIONS

This is a ready reference to getting ready for construction work. It gives, clearly and concisely, fundamental data on the preparation of contracts and specifications—not from the technical side, but from the legal. This is the third edition. Added material includes data on cost plus fixed fee contracts, insurance, bonding, contracts for engineering and architectural services and specification writing. It is a good book, but your editor thinks that cutting out every "a", "an" and "the" is no way to write, even if you do save a line of type now and then. Contributors to PUBLIC WORKS will please insert these where needed and let us do the cutting out. 415 pages. Robert W. Abbett, John Wiley & Sons, Inc., New York. $6.

STRUCTURAL DESIGN IN REINFORCED CONCRETE

A new book, this, which ought to help a good many folks with some of the common problems in reinforced concrete. It starts off with moments and shears for continuous structures and follows with bending and direct stress. Then it goes into the design of retaining walls and footings, arches and box culverts. Then comes something of special interest to many sanitary engineers—the design of circular tanks, which is not always covered in concrete texts. There is considerable on prestressed concrete and more on concrete construction. By Clifford D. Williams and Charles E. Cutts. Ronald Press Co., New York. 308 pages; well illustrated; $6.

FOR OPERATORS OF WATER & SEWAGE PLANTS

The proceedings of the 16th annual short course for operators of water and sewage treatment plants has been published by the Engineering Experiment Station, Louisiana State University, Baton Rouge, La., as Bulletin No. 41. It contains thirteen papers on water and sewerage topics, and sells for $1.

Used on jobs

When an installation, once completed, should be as trouble-proof as planning and materials can make it—engineers rely on cast iron pipe. It has high beam-strength, compressive-strength and shock-strength. Its effective resistance to corrosion ensures long life, underground or underwater. These are reasons why cast iron pipe is so widely used for water lines in tough terrain, pressure and outfall sewers, river crossings, and encased piping in sewage treatment and water filtration plants. For further information write: Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3, Ill.

(above)
Cast iron mechanical joint pipe installed in connection with a new, larger sewage treatment plant at Rochester, Minn.

(at right)
Installing cast iron mechanical joint pipe used in air-conditioning system for Northland Shopping Center, Detroit, Mich.

CAST IRON PIPE

BITUMULS® is used with confidence

THIS PICTURE tells a story that has deep significance for Roadbuilders everywhere. It shows a group of our Field Engineers attending a "class" that is being held at our training Laboratory.

The group contains men of varying ages, some with long service with our company; others with very few years behind them. Engineers all, they are here for a program of education and re-education. This we maintain to keep all of our men informed on the latest techniques in asphalt paving.

From all over the nation, factual jobs, reports, specifications, motion pictures, slide films, and photos—are gathered and sent for instructional use at this information center. At regular intervals, groups of our Field Engineers attend this "school." They then return to their own areas with newest information on the application of ours and other products.

The reason for this program is simple: we want you, the Roadbuilder, to be able to accept the word of our Field Men with confidence; because it is only in terms of his ability to serve you that the worth of our products can be measured.

There's a Bitumuls Field Engineer working out of an office near you. Call him anytime that you feel he can be of service.

Ask for our new booklets, "Bitumuls Surface Treatments and Penetration Pavements," and "Bitumuls for Maintenance."

AMERICAN Bitumuls & Asphalt COMPANY

200 BUSH STREET, SAN FRANCISCO 4, CALIFORNIA

E. Providence 14, R. I. Perth Amboy, N. J. Baltimore 3, Md. Mobile, Ala.
Columbus 15, Ohio Tucson, Ariz. Seattle, Wash. Baton Rouge 2, La.
St. Louis 17, Mo. Inglewood, Calif. Oakland 1, Calif. Portland 7, Ore.
Washington 5, D. C. San Juan 23, P. R.

Now's the time to mail this month's Readers' Service card.

FREE EQUIPMENT DATA to Help Your PUBLIC WORKS PROGRAM

NEW LISTINGS

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the coupon, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field.

Get Data on Concrete Standards For Street and Highway Lighting

153. Beauty, economy and durability are combined in "Hy-Lite" concrete standards for street and highway lighting. Centrifugally spun, pressure-dense reinforced concrete with polished finish provides attractive appearance; requires no maintenance. For illustrated bulletin including full specifications write American Concrete Corp., 5092 N. Kimberly Ave., Chicago 30, Ill. or check the coupon.

Chipping Machine Handles Concrete Removal

225. Details on a high-speed concrete router which handles surface removal prior to resurfacing operations is offered by the G. H. Tennant Co., 2578 No. 2nd St., Minneapolis 11, Minn. Be sure to investigate this versatile machine which, with interchangeable cutter heads, will rout out cracks, clean pavement joints, level humps, etc. Check coupon for details.

Engineering Data on Tilting Disc Check Valves

196. The Chapman tilting disc check valve is designed to lift away from the body seat without sliding or wearing; closes without slamming. Operating principles, details of construction, dimensions, recommendations and engineering data are fully covered in 18-page Bulletin No. 30. Get your copy by checking the coupon or write to Chapman Valve Mfg. Co., Indian Orchard, Mass.

Light Weight Machines Do Work of Heavy Rollers

204. For compacting hot or cold patching material, granular soils, macadam construction, and other applications where controlled densities are required, be sure to investigate Jackson electric vibratory compacting equipment, available in 12 in. to 12 ft. widths to meet all requirements. Get details in Bulletin 153 by checking the coupon. Jackson Vibrators, Inc., Ludington, Mich.

Traffic Line Stripers For Quick, Clean Work

244. Helpful information to assist you in choosing striping machines which will fit your needs best is provided in a comprehensive catalog covering latest models of "Reflecto-Liner" striping machines and equipment made by Wald Industries, Inc., Montgomery, Pa. Get General Catalog W-10 by checking the coupon.

One Basic Unit with Attachments Does a Multitude of Jobs

149. You'll find full descriptions of the Davis Pit-Bull unit and versatile, easy-to-change attachments in the handsome new bulletin of Mid-Western Industries, Inc., 1009 S. West St., Wichita, Kans. There's a loader, trencher, dozer, roller, mower, rotary broom, post auger, crane, hammer and lift fork units for every type of municipal maintenance and construction job—all coordinated for use with the same powerful basic unit. Be sure to investigate this remarkable equipment. Get the full story by checking the coupon.

How to Modernize Traffic Controls

219. Technical data on mercury relays for maintenance-free dependability in traffic controls is offered by Adams & Westlake Co., 1179 N. Michigan, Elkhart, Ind. Get latest data by checking the coupon. For special advisory service on your particular problems, contact the company direct.

How a City May Overcome Refuse Disposal Complaints

260. "The Story of Mid City—and its Sanitary Landfill" is a new cartoon-style booklet released by Caterpillar Tractor Co., Peoria, Ill. The 16-page booklet tells the evils of the old open dump and the investigations made by foresighted city officials to obtain inexpensive, efficient disposal methods. Check the coupon for your copy.

Engineering Data on Incinerator Appurtenances

171. Charging and ash gates, water sealed ash hoppers, ash scraper conveyors, pneumatic ash conveyors, skip hoists and covering equipment to minimize odors and reduce labor costs are among the many incinerator appurtenances described in literature of the Beaumont Birch Co., 1508 Race St., Philadelphia 2, Pa. Check the coupon for this data.

Sewer Capacity Speedily Restored By "Reboring" Service

178. An attractive brochure offered by National Power Rodding Corp. describes their mobile unit with specially designed power rodding drive and central mechanism that gets on the job fast; rebores clogged sewers and drains cleanly and safely without impending traffic or disturbing property. Check the coupon or write National Power Rodding Corp., 4600 West Madison Ave., Chicago 44, Ill.

Fast Marker for Traffic Guide Lines

188. Free-floating, adjustable paint shields on the Mark-Rite Econo-Liner follow surface contours and produce sharp lines in any width from 2" to 6". This machine is said to paint 10,000 to 15,000 feet of line per hour. For details get Form E-100 from Universal Mfg. & Sales Co., 5211 Pacific Blvd., Huntington Park, Calif.

Red Stop Signs for Greater Effectiveness

193. Join the hundreds of municipalities that are investigating reflectorized RED stop signs for greater effectiveness in day or night traffic control. Full data on non-fading, long life, economical signs offered by U. S. Porcelain Enamel Co., 4635 E. 52nd Dr., Los Angeles 22, Calif. Just check the coupon.

New Ease in Concrete Sawing

212. The Eveready "Powr-Drive" saves operator effort and increases cutting footage by controlling speed according to various requirements. Get full data on Eveready concrete saw with "Powr-Drive" from Eveready Briksaw Co., 1509 S. Michigan Blvd., Chicago 5, Ill. Use the handy coupon today.

Street Lighting Application Curve Eliminates Calculations

257. An easy-to-use chart from which illumination level, spacing and proper mounting height can be determined has been prepared by the Illuminating Engineering Laboratory, General Electric Co., West Lynn 3, Mass. For a copy of the chart and instructions on its use check the handy coupon.

6-54

USE THIS COUPON to get detailed information on products and materials mentioned in this issue. Circle numbers below and mail today.

STOP READ AND SEND

Booklets from pages 32 to 50:

20 23 25 26 28 29 30 33 36 41
42 43 44 45 46 48 49 59 60 69
72 78 81 84 86 87 88 89 92 93
94 99 108 109 110 115 116 117 120 123
132 136 143 144 148 149 153 157 160 162
168 171 174 175 178 186 188 189 191 193
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222 224 225 230 232 236 239 244 245 246
248 249 251 255 256 257 258 260 262 266
269 270 273 275 276 278 280 282 286 288
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New Products, pages 162 to 167:

6-1 6-2 6-3 6-4 6-5 6-6 6-7 6-8 6-9 6-10 6-11
6-12 6-13 6-14 6-15 6-16 6-17 6-18 6-19
6-20 6-21

Name .....

Occupation .....

Street .....

City ..... *State* .....

NOT GOOD AFTER JULY 15, 1954 MAIL THIS CARD NOW

To order these helpful booklets check the coupon on page 32.

Instrumentation for Sewage Plant Operation

262. A detailed description of the test methods and instrumentation required for rapid, efficient and accurate laboratory control of sewage treatment plants is presented in a comprehensive report issued by General Laboratory Supply Co., Box 2607, Paterson, N. J.

Comprehensive Catalog On Clay Products

269. A 62-page catalog covering all types of vitrified clay pipe, fittings, liner plates and kindred clay products has been issued by the Superior Clay Corp., Ulrichsville, Ohio. To get this attractive, pocket-sized catalog just check the coupon.

New Ring-Tite Joint For Transite Pressure Pipe

251. Ring-Tite, the new coupling for Transite Pressure Pipe, is the subject of a 6-page illustrated folder just issued by Johns-Manville, 22 East 40th St., New York 16, N. Y. Time-saving installation methods and economies made possible by the use of this coupling are explained. Check the coupon for your copy.

Handbook Covers Flow Metering

255. Flow metering systems for every application; basic operating principles; details on indicating, recording, integrating and controlling instruments; installation information and helpful engineering data will be found in 56-page catalog 2320 issued by Minneapolis-Honeywell Regulator Co., Industrial Div., Philadelphia 44, Pa. Check the coupon for this valuable reference.

Permanent Traffic Markings With "Perma-Line"

136. Traffic markings for center lines, crosswalks and other uses may be installed permanently by the use of "Perma-Line", a plasticized filler which, after curing, becomes an integral part of the road itself. For more data on the process and reports of public works officials and testing laboratories,, write to Perma-Line Corp. of U.S., 10 West 47th St., New York 19, N. Y., or check the coupon.

Manual Covers All Types Of Pipe and Service Repairs

266. Full details on the entire line of Skinner-Seal pipe repair clamps, service fittings and drilling equipment are presented in a new catalog and service manual offered by the M. B. Skinner Co., South Bend, Ind. Step-by-step installation pictures and captions give clear, concise instructions for the repair of all types of pipe leaks. Get helpful Catalog GW by checking the coupon.

For prompt catalog service always use the PUBLIC WORKS reply card or coupon.

Two-Way Radio Equipment For All Departments

363. The benefits of two-way radio communication in the uncongested non-interference 450-megacycle range make full information on this subject important to all engineers. Get full data on trouble-free systems from Motorola, Inc., Dept. PW, 4545 Augusta Blvd., Chicago 51, Ill. Just check the coupon.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

258. Latest information on the Komline-Sanderson "Coilfilter", which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 102 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the coupon today.

Engineering Data on Aluminum Lighting Standards

256. Latest designs and applications of all-aluminum, seamless, tapered lighting standards, traffic signal posts and elliptical lighting brackets plus detail drawings and mechanical specifications are provided in a comprehensive 16-page bulletin issued by Pfaff & Kendall, 84 Foundry St., Newark, N. J.

Helpful Data on Bermico Pipe Fittings

280. Data are now available on fittings for use with Bermico sewer pipe and perforated pipe—T's, Y's and bends to make complete root-proof, water tight, corrosion-resistant Bermico pipe systems. Get full information by checking to coupon. Brown Co., 150 Causeway St., Boston, Mass.

Get Full Data On Aggregate Spreaders

286. Accurate control for spreading crushed rock, chips, sand or ice control materials is featured by all models of Highway Equipment Co. materials spreaders. Data on both trailer and tailboard types available by checking the coupon. Highway Equipment Co., 630 D. Ave., Cedar Rapids, Iowa.

The Bros Line of Road Machinery

289. An illustrated folder describing the Bros line of road machinery is available from Wm. Bros Boiler & Manufacturing Co., Minneapolis 14, Minn. Full descriptions of Bituminizer distributors, Spraymatic spray bars, several types of compacting equipment and other units are included. Check the coupon.

How to Simplify Your Weed Spraying Operations

293. Chemical spraying for weed control is made simpler and easier by the Tarrant "Direct from the Drum" sprayer, a compact power spraying unit which will handle dozens of jobs. Get full data from Tarrant Mfg. Co., 27 Jumel St., Saratoga Springs, N. Y. Check the coupon.

To order these helpful booklets check the coupon on page 32.

WATER WORKS

Data on Cutting-In Valves, Repair Sleeves and Accessories

33. A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes, Strickler pipe cutters and other fittings and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6600-A, Chicago 80, Ill. Check the coupon.

Meters and Instruments For Water Works

43. An attractively arranged 20-page booklet issued by Sparling Meter Co., Box 3277, Los Angeles 54, Calif., furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the coupon for your copy.

Technical Data on Fluorides And Other Chemicals

48. Technical data on fluorides and other chemicals will be found in a comprehensive booklet issued by Blockson Chemical Co., Joliet, Ill. This helpful 60-page booklet includes a great deal of general information of value to water works men. Get a copy by checking the coupon.

Helpful Data on Water Works Products

49. A completely new catalog covering the entire line of water distribution and service products offered by the Mueller Company, of Decatur, Ill., is now available to engineers and water works superintendents. The 328-page catalog features an easy-to-use sectional indexing arrangement to facilitate quick reference to any of the hundreds of products listed. A large section of useful engineering information is included. Check the coupon today.

Meter Features That Help Make Water Works Profitable

59. Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American water meters described in Bulletin No. 50 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Get your copy by checking the coupon.

Makes Underground Pipe Installations Easy

115. One-man operated hydraulic pipe pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts ask for Form E-213, Greenlee Tool Co., Rockford, Ill. Just check the coupon.

Discussion of Ranney Method For Municipal Water Production

116. A very interesting study of municipal and industrial water supply problems and a complete discussion of Ranney Collectors for water production will be found in a 20-page booklet published by Ranney Method Water Supplies, Inc., Box 277, Columbus 9, Ohio. Water quality, construction methods, costs, performance and other topics are considered. Check the coupon to get your copy.

Pipe Detector Determines Exact Location and Depth

120. Determination of the exact location and depth of buried pipes, valves, service cables and other metallic objects can save costly digging and unnecessary damage. Your work can be speeded when you use the Detectron pipe detector, which features simple operation, shielding to avoid static interference, economical unit construction and a lifetime guarantee. Get full data from Detectron Co., 5631 Cahuenga Blvd., No. Hollywood, Calif., by using the coupon.

Efficient Underdrains for Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the coupon or write F. B. Leopold Co., Inc., Dept. PW, 2413 W. Carlson St., Pittsburgh 4, Pa.

Complete Booklet on Pipe Line Equipment

246. Equipment for all types of jointing, maintenance and repair jobs on water, gas and sewer lines is described and illustrated in Catalog No. 25 issued by Joseph G. Pollard Co., New Hyde Park, N. Y. Leak detectors, pipe finders, melting kettles, cleaning tools and a full line of hand tools for water and sewer departments, and many other items are included. Be sure to get your copy now. Just check the coupon.

Chemicals Used in Water, Sewage and Waste Treatment

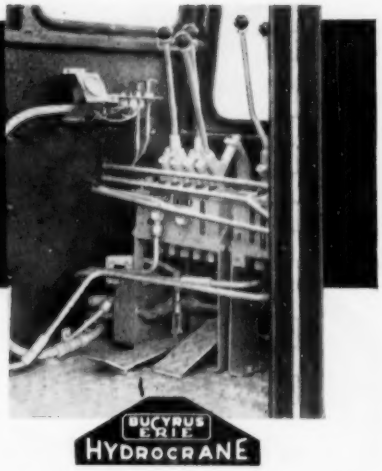
248. A 16-page technical bulletin offered by Omega Machine Co., 345 Harris Ave., Providence, R. I., compiles in convenient form full information on the chemicals used in water, sewage and waste treatment. Data includes formulas, common names, commercial strengths, forms in which they may be obtained, sizes of shipping containers, and many other items, including recommendations for handling and feeding. Get this useful bulletin by checking the coupon.

Engineering Data on the Permutit Precipitator

270. A well illustrated 20-page booklet, Bulletin 2204B, describing the many applications, principles of operation, design features, advantages, flow diagrams and specifications of the Permutit Precipitator in its three basic designs has been released by The Permutit Co., 330 West 42nd St., New York 36, N. Y. Full data is provided to determine the size and type of unit best suited for every water treatment purpose. For copies write to the manufacturer or use the coupon.

Now's the time to mail this month's Readers' Service card.

BUCYRUS-ERIE presents NEW UP-RATED SELF-POWERED HYDROCRANE with selector valve



Now Bucyrus-Erie offers a new, more powerful all-hydraulic crane-excavator — the self-powered H-3 Hydrocrane. Taking its power from its own 4-cylinder industrial engine instead of from the truck engine, the new self-powered Hydrocrane provides the following big advantages:

1. **Increased horsepower** through eliminating restrictive influence of side-mounted truck power take-off.
2. **Selector valve operation.** Power concentration selector unit permits channeling hydraulic fluid from all three pumps to one valve bank — increases line speeds up to 50%.
3. **Convenient operation.** Selector valve is foot operated — provides metered control of higher speeds—operator need not let go of hoist and swing levers to operate selector valve. Controls for power plant conveniently grouped at operator's station.
4. **Reduced crane maintenance** from simpler more direct power application. High pressure hoses through center pin leading from pumps to valve bank eliminated. Fewer belts, shafts, and hoses.
5. **Improved efficiency.** Improved oil filtering with less restriction. Better cold weather performance.
6. **Improved truck engine life.** Economy results from fewer truck repair bills. Generator for independent power plant re-charges motor truck battery. Overall fuel consumption is less.

1H54

These are just a few of the advantages of the new self-powered Hydrocrane — and self-power is just one of the big features that is making the Hydrocrane foremost in 1954. See your distributor for complete details.

Bucyrus-Erie Company
South Milwaukee
Wisconsin, U.S.A.

Get full details of this month's products . . . mail your Readers' Service card today.

To order these helpful booklets check the coupon on page 32.

Pipe Joint Essentials and Couplings for Every Job

168. Superior pipe joints are tight, flexible, simple, strong and economical. Dresser's handsome 34-page bulletin No. 513 shows how these essentials are met and provides layouts for curves, working pressures and a wealth of other data. Be sure to check this bulletin on the coupon. Dresser Mfg. Div., 59 Fisher Ave., Bradford, Pa.

All-Electric Floatless Liquid Level Control

174. Description of operating principles and application of B/W controls show the simplicity and many uses of these all-electric, floatless devices. Get latest bulletins for engineering data, diagrams of typical installations and details of component parts. Check the coupon or write B/W Controller Corp., Dept. PW, Birmingham, Mich.

Locate Mains, Services and Leaks Without Digging

186. A 16-page booklet tells how to use the Fisher "M-Scope" to locate buried pipes, cables, valves, manhole covers, conductive and non-conductive sewer pipes and septic tanks by electronic means. Dry battery operated. Only one man is needed for operation. Get data from Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif., by checking the coupon.

What You Should Know About The Centriline Process

197. The Centriline method for cement mortar lining water mains 16" thru 144" in place to stop leaks, prevent corrosion, increase carrying capacity and decrease pumping costs is fully described in a handsome booklet issued by the Centriline Corp., 140 Cedar St., New York 6, N. Y. Many illustrations and typical case histories show the operation and economics of this process. The Tate process for lining smaller mains is also covered. Check coupon for your copy.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal, control of certain tastes and odors, plus other aids in high quality water production. Check coupon for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Theory and Application Of the Flow Tube

84. Hydraulic formulae, head capacity curves and test data for this primary metering element are given in a technical bulletin, "Theory and Application of the Flow Tube," available from Foster Engineering Co., Union, N. J. Check the coupon for a copy.

All About Centrifugal Pumps

361. Where pumping performance counts you want to check your specifications carefully. Investigate the features of Fairbanks-Morse centrifugals. Use coupon or write to Fairbanks, Morse & Co., Dept. P. W., Chicago 5, Ill.

Helpful Data on Swimming Pools

364. Data on injector nozzles for complete recirculation, fittings for correct drainage and other useful information for pool design are covered in Manual SP issued by Josam Mfg. Co., Michigan City, Ind. Check coupon for your copy.

How Your Filter Washing Can Be Improved

368. More effective sand washing with elimination of mud balls and bed cracking with resultant longer filter runs are claimed for the Palmer Filter Bed Agitator, described in bulletins issued by Palmer Filter Equipment Co., Erie, Pa. Get latest data by checking the coupon.

Technical Bulletin on Solenoid Operated Valves

288. Full technical data on applications, construction, dimensions and specifications of Golden-Anderson Cushioned solenoid operated valves is contained in Bulletin W-7, available from Golden-Anderson Valve Specialty Co., 1232 Ridge Ave., Pittsburgh, Pa. Selected valve patterns are offered in ½ to 2-in and 2½ to 36-in. sizes. Get all the details; just check the coupon.

Instrumentation and Control Equipment For Water and Sewage Plants

298. Full engineering data on the instrumentation and control equipment needed in water works, sewage plants, pumping station and related installations are provided in the "Application Engineering Data" binder issued by the Foxboro Co., Foxboro, Mass. Every engineer and designer should have this valuable material on hand. Check the coupon if you can use this data.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 45, Wis. Check the coupon for your copy.

Here's Help for Laboratory Planning

369. A comprehensive laboratory planning guide that tells the engineer and designer how to obtain maximum space economy; utilize new and present facilities; and use functional design in locating utilities, ventilation and lighting is now available from Metalab Equipment Corp., Hicksville, L. I., N. Y. Complete data includes sectional and interchangeable lab equipment, furniture and accessories. Check the coupon for this valuable planning aid.

short cut to bigger profits...

OLIVER DIESEL AND STRAIT-LINE LOADER!

With this bulldozer attachment the Strait-Line becomes even more profitable. Rear-carried bucket adds traction that makes heavy dozing easy. Blade does not interfere with loader operation. Other attachments include lifting boom, fork, and a variety of buckets from ¾- to 2-yd. capacity.

Diesel economy and short-cycle loading—that's how the Oliver diesel tractor and Strait-Line loader short-cut to more profit on any loading job. Compare this unit with other loaders... it digs in *front* or *rear* and loads in front... always working in a straight line. The rear-carried bucket increases traction, makes steering easier and permits bigger loads.

Now add the ruggedness and economy of either the Oliver "77" or "88" diesel tractor. Here is a 6-cylinder diesel you can count on for quick starts and down-right lugging ability to do more work at less cost. Get acquainted with this unit by driving it yourself. Check its features and you'll see why you get more yardage at a lower cost with an Oliver diesel and Strait-Line loader. See your Oliver Industrial Distributor.

THE OLIVER CORPORATION

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a complete line of industrial wheel and crawler tractors

Thousands use our Readers' Service card to keep up to date... do you?

To order these helpful booklets check the coupon on page 32.

Pollution-Proof Outdoor Drinking Fountain

144. An outdoor drinking fountain so designed that contamination by cross connections or back siphonage is not possible is fully described in a 4-page bulletin. Features neat appearance, easy installation. Write Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio, or use coupon.

Faster Pipe Laying With Precaulked and Threaded Joints

148. McWane 2" cast iron water pipe with threaded joints and precaulked bell and spigot pipe are described in folder WM-47. Additional data on 3" to 12" centrifugally cast pipe and fittings in folder WL-47, both issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala.

Helpful Data On Pipe Tools

230. Toledo drop head ratchet threaders are light, compact, ideally suited for work in tight corners. Three models for ⅛" to ¾"; ⅛" to 1¼"; and ¼" to 2" pipe all feature quick change of sizes. Get Catalog 12A53 from Toledo Pipe Threading Machine Co., Toledo, Ohio. Check the coupon.

Reference Book on Lubricated Plug Valves

273. Lubricated plug valves, including stick-proof lever sealed valves for easy operation and positive mechanical seal are fully described in reference books issued by Homestead Valve Mfg. Co., Box 550, Corapolis, Pa. Check the coupon for your copy.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in a convenient booklet offered with the compliments of U. S. Pipe and Foundry Co. Birmingham 2, Ala. Get your copy by checking the coupon.

Water Treatment Unit For Small Supplies

87. A complete-package water treatment unit to treat 5 to 100 gallons per minute is described in Bulletin 1870, issued by Infilco Inc., Box 5033, Tucson, Ariz. Unit softens, clarifies, sterilizes or removes organic matter, tastes or odors. Requires a minimum of attention. Investigate this unit whenever dependable treatment is needed for small domestic supplies. Check the coupon today.

Design Data on Chemical Flocculating Equipment

89. Flash mixers, Straightline mixers, conveyors and elevators for handling chemicals are described in illustrated Bulletin No. 2442 available from Link-Belt Co., Colmar, Pa. Selection tables and diagrams are provided to help you select the equipment best suited to your needs. Check the coupon for your copy.

Floatless Liquid Level Controls

92. Complete descriptions of electrode type floatless liquid level control systems, including control units, electrodes and fittings, panel assemblies and diagrams of typical installations for all types of municipal service are covered in the 32-page catalog of Charles F. Warrick Co., 1956 W. Eleven Mile Rd., Berkley, Mich. Check coupon for your copy.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

Have You Investigated Aluminum Gratings?

200. Aluminum gratings for walkways, bridge decking, and stair treads save weight, resist corrosion and are easily handled. Get complete design data, including safe load tables, standard panel widths and weights, from Irving Subway Grating Co., 50-53 27th St., Long Island City 1, N. Y. Just check the handy coupon.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co, Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the coupon.

Helpful Valve Catalog For Engineers

236. For complete descriptions of Darling double disc, parallel seat gate valves be sure to get Bulletin 5002 issued by Darling Valve & Mfg. Co., Williamsport, Pa. Construction details covering all valve parts and accessories are helpful for specification writers. Check the coupon for your copy.

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CONSTRUCTION EQUIPMENT AND MATERIALS

Attachments Keep Snow-Thrower On Job the Year 'Round

46. A variety of attachments designed to fit the rugged tractor unit of the Maxim Snow Thrower make it an all-year worker ready for mowing, cutting, dozing, towing and rolling. Full details on these economical snow throwers and their useful attachments are covered in bulletins offered by Maxim Silencer Co., 85 Homestead Ave., Hartford, Conn. Check the coupon for this data.

Model DVS manually controlled Chlorinizer installed at Estacada, Oregon — Supt. Glen Ebert at left, Mayor Ford A. Darrow, at right.

CHLORINIZER Made a Big Difference in the Small Town of Estacada, Oregon

For the 1,000 people of Estacada, this Builders Model DVS Chlorinizer represents an important municipal economy. Previously another type of equipment had cost up to $10.00 a month in heating bills alone to overcome a serious "chlorine ice" problem. With the Chlorinizer, safe and dependable chlorination has been maintained even when water temperature dropped to 33° F. and air temperature stood at 17° F. . . . further proof of the advantage of metering and controlling chlorine gas in the dry, inert state.

Since early 1953 when the installation was made, the Chlorinizer has been in service continuously, and has required almost no maintenance. In a town of this size, municipal budgets cannot afford specially trained chlorination maintenance men. The Chlorinizer has operated since installation completely without need for specialized personnel.

More and more, the trend is to Chlorinizer, for new projects, for replacement, for plant expansion. Find out for yourself why this safe, simple, dependable chlorine gas feeder will save you money and serve you well. Write for descriptive Bulletins. Builders-Providence, Inc., 356 Harris Ave., Providence 1, Rhode Island.

Mayor Ford A. Darrow of Estacada, Oregon states, "We had considerable trouble with another make . . . and to date have had no trouble with Chlorinizer. We are entirely satisfied and would recommend this chlorine gas feeder".

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B·I·F METERS FEEDERS CONTROLS

To order these helpful booklets check the coupon on page 32.

Be Sure to Check Your Tractor Shovel Needs

94. A comprehensive 16-page catalog now available from Frank G. Hough Co., 761 Seventh St., Libertyville, Ill., shows how cities, counties, contractors and others use the Model HR four-wheel drive Payloader on earth and material handling jobs. Be sure to check the ways you could use this machine. Get Form No. 225 by checking the coupon.

Examining a Tractor Piece by Piece

99. The 32-page catalog published by International Harvester Company should be studied by every tractor owner, for in it each unit from engine to track of the TD-9 Diesel is considered separately. These piece by piece discussions are supplemented by notes on easy servicing, versatile applications and attachments for every need. Get your copy of form CR-313-A from International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or check the handy coupon.

Booklet Helps Design of Custom-Engineered Steel Buildings

110. Custom-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful 32-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Use the coupon or write to Butler Mfg. Co., Kansas City, Mo.

Manual on Retaining Wall Design

160. Embankment stabilization with Armco Bin-Type Retaining Walls is discussed in a 16-page illustrated booklet offered by Armco Drainage and Metal Products, Inc., Middletown, Ohio. Included are case histories which show embankments along highways, lakes, streams and city streets. Technical data covers selection of design and units required for various sections, curves and grades. Use the handy coupon.

8 Reasons Why You Should Check the Jaeger Loader

207. In a profusely illustrated 16-page catalog devoted to the applications and special design features of the Jaeger "Load-Plus" tractor-loader unit, eight good reasons listed to back up the claim that this machine outproduces any other loader of its size. These include load capacity, balance, reach, maneuverability, automatic power adjustment by torque converter, instant reversal, multiple speed and ease of control. Check them all by getting a copy of Catalog L100-3. Check the coupon today. Jaeger Machine Co., 400 Dublin Ave., Columbus 15, Ohio.

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer. Get your copy of this valuable catalog by checking the coupon today.

Get Jobs Done Faster With Multipurpose "Scoopmobile"

282. The efficient Model C Scoopmobile cuts time and labor costs with its versatile applications and quick-change accessories. Features power steering; three-wheel maneuverability; scoops, loads, transports, hoists. Get full data from Mixermobile Manufacturers, 8027 N.E. Killingsworth, Portland 20, Ore. Check the coupon.

The Loader That Digs Like a Power Shovel

317. The power crowder-arm of the Lessmann loader gives you power shovel advantages in this tractor-mounted unit, and enables you to fill the bucket in tough digging without spinning the wheels. Check the coupon for all details on this rugged, heavy-duty unit. Lessmann Mfg. Co., Des Moines 4, Iowa.

To order these helpful booklets check the coupon on page 32.

Faster Compaction On Street Repairs

108. Holes and trenches cut through pavement present difficult areas for compaction of backfill. Learn how to do the job quickly, easily and cheaply by using the self-contained, portable Barco Rammer. Full data on this low cost will be found in Bulletin 621. Write Barco Mfg. Co., 500 No. Hough St., Barrington, Ill., or check the coupon.

What A Road Roller Should Give You

325. Many engineering design features that make Buffalo-Springfield rollers the answer to your needs are described in an attractive bulletin covering the C-Model Two-Axle Tandems of Buffalo-Springfield Roller Co., Springfield, Ohio. Included are details on open gridwork for better operator visibility, increased ground clearance and bevel gear drive. Investigate these and many other features listed in Form No. S 61-53. Check the coupon.

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SEWERAGE AND WASTE TREATMENT

Data Offered on Root-Proof Pipe and Fittings

352. Orangeburg sewer pipe and fittings with root-proof Taperweld joints are described in a comprehensive bulletin offered by Orangeburg Mfg. Co., Orangeburg, N. Y. Detailed information is included on layouts and installation for sewerage and drainage. Get 12-page Catalog No. 306 by checking the coupon.

Packaged Sewage Treatment— Just Right for Small Places

36. "Packaged" Sewage Treatment Plants specifically developed for small communities—100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 622 Diversey Pkwy., Chicago 14, Ill.

Design Data Offered On The Spiragester

42. The Spiragester, a unit which combines the Spirafio Clarifier and a digestion compartment in a two-level arrangement to save space and reduce construction costs, is fully described in Bulletin 124 released by Lakeside Engineering Corp., 222 West Adams, Chicago, Ill. Design details, including capacities for 8' to 24' units are furnished together with typical plan and elevation. Check the coupon for this helpful bulletin.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete, easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 40-page booklet issued by Flexible Sales Corp., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the coupon for your copy of this helpful handbook.

Effective Shredder For Dried Sewage Sludge

72. The rugged and compact Royer Sludge Disintegrator does a quick and effective job of preparing sludge for use as a fertilizer on city properties or for sale to others. Several models, portable and stationary, suitable for every size plant and power source are described in Bulletin 643-A, issued by the Royer Foundry and Machine Co., Kingston, Pa. Get a copy by checking the coupon.

Helpful Design Data For Sewage Ejectors

81. The applications and advantages of pneumatic sewage ejectors are outlined in a new bulletin of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems. Get your copy by checking coupon

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers. Requests for this valuable booklet must be made on business letterhead.

Assistance in Planning Electrical Systems

189. On every water and sewage plant expansion, modernization or new construction job, you can get valuable assistance in planning the electrical system from Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. Be sure to investigate compact, unitized Westinghouse equipment which conserves building space and simplifies maintenance. Check the coupon for full data.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 52-page Catalog 833. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors this valuable booklet. Use coupon or write and other related units. Photos and drawings of installations plus capacity tables complete Jeffrey Mfg. Co., 947 N. 4th St., Columbus 16, Ohio.

Efficient Blowers for Activated Sludge Plants

232. Many advantages of Roots-Connersville positive displacement rotary blowers are described in Bulletin 22-23-B-13, which also provides characteristic curves for operation with constant speed, multi-speed and variable speed motors and details of several types of blowers. Get this helpful bulletin by checking the coupon. Roots-Connersville Blower Corp., Connersville, Ind.

To order these helpful booklets check the coupon on page 32.

Submersible Sewage Ejector Simplifies Installation

275. The Weil submersible non-clog sewage ejector is a compact unit with a completely sealed motor, available in several sizes with capacities up to 300 gpm. For details on unit selection, installation methods, construction features and controls get Bulletin SE-860A from Weil Pump Co., 1530 No. Fremont St., Chicago 22, Ill. Check the coupon.

Chemicals Used in Water, Waste and Sewage Treatment

276. A new chart giving information on the form, weight, solubility, strength and use of common water, sewage and waste treatment chemicals is available from Wallace & Tiernan, Belleville 9, N. J. Data on materials suitable for handling each chemical in either its dry or solution form are included. Check the coupon today.

Get the Facts on The Contact Aeration Process

303. Full engineering details on the submerged contact aeration process of sewage treatment, including diagrams of plant units, area requirements, operating costs and other details are available in a bulletin of the Hays Process Co., Box 768, Waco, Texas. Check the coupon to get the facts.

Discussion of Sewage Chlorination

316. Sewage chlorination and factors in selecting chlorine gas feeders are discussed in Keep Sheet No. 15 issued by Builders-Providence, Inc., 356 Harris Ave., Providence 1, R. I. All factors related to sewage chlorination are covered in this valuable reference leaflet. Check the coupon for your copy.

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 310 E. 45th St., New York 17, N. Y. Check the coupon and we will forward your request.

How Cities Clean Sewer Lines From Street in One Operation

25. In a helpful 28-page handbook of sewer cleaning methods and equipment the makers of OK Champion sewer cleaners give full details of power and hand operated models. Also included are data on expansion buckets that take dirt from sewer to street in one operation, root cutters and other accessories. Get your copy by checking coupon. Champion Corp., 4752 Sheffield Ave., Hammond, Ind.

Book Tells How to Control Root Stoppages

249. Details on the proven use of copper sulfate to control root and fungous growths in sewers are contained in a brand-new book published by Phelps Dodge Refining Co., 40 Wall St., New York 5, N. Y.

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STREETS AND HIGHWAYS

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the coupon. American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 4, Calif.

Better Mowing and Brush Removal

30. Fast, versatile Wood's rotary mowers are available in nine models, 42" to 114", to suit all types of municipal maintenance. Upkeep costs for roadside mowing, brush cutting, leaf mulching, park maintenance, airport maintenance, can all be reduced with efficient equipment. Get full details by checking the coupon. Wood Bros. Mfg. Co., Box 148B, Oregon, Ill.

Do You Have Complete Black Top Equipment Data?

41. In 36-page catalog AA a full line of maintenance is covered. Units described and illustrated include several models of pressure distributors, supply tanks, sprayers, brooms, asphalt kettles, portable rollers, and accessory tools. Use coupon for copy of this handy manual. Littleford Bros., 452 E. Pearl St., Cincinnati 2, Ohio.

How Electro-Matic Controllers Solve Problem of Congested Intersections

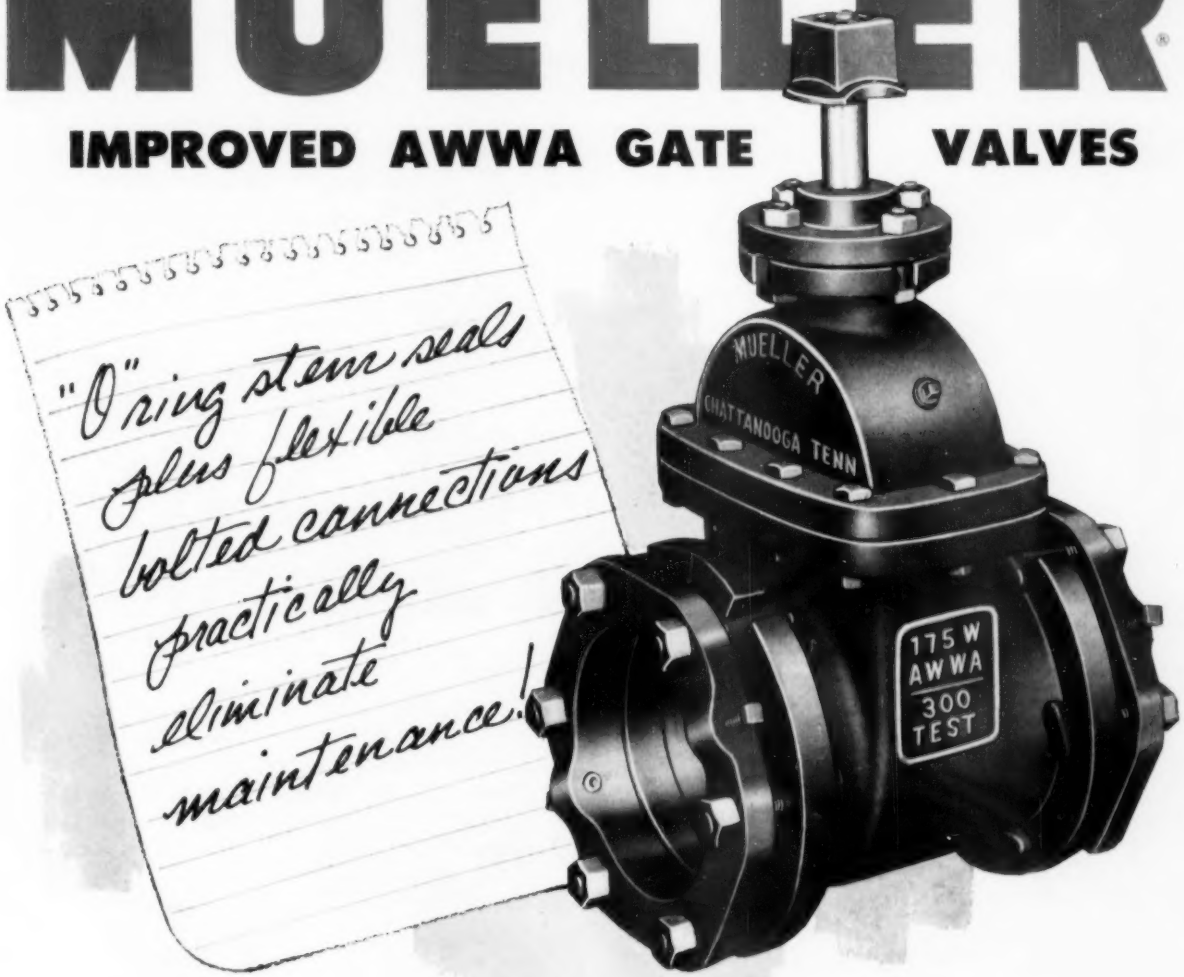
60. Traffic control systems regulated by Electro-Matic Controllers continually adjust to changing traffic patterns to clear traffic faster and relieve the problem of congested intersections. Be sure to investigate this method of expediting traffic flow at difficult intersections. Get full data from Automatic Signal Div., Eastern Industries, Inc., East Norwalk, Conn. Just check the handy coupon.

New Economy in Brush Clearing Work

78. Quick, effective brush cutting with the Brushmaster saw lets one man do the work of six when clearing brush for highway departments, on watersheds, along right-of-ways. Brambles, briers, vines, bushes, brush and saplings up to 4" dia. are easily cut with this lightweight, powerful tool. For full data check the coupon. Brushmaster Saw, Inc., 89 Emerald St., Keene, N. H.

MUELLER®

IMPROVED AWWA GATE VALVES



Maintenance costs are reduced to a minimum when using Mueller Gate Valves featuring "O" ring stem seals and mechanical joints.

Two "O" rings, replacing conventional stem packing, completely eliminate repacking or retightening and assure a dependable, lasting seal. "O" rings have proven highly effective as sealing devices and do not deteriorate. The space between the "O" rings is filled with a special lubricant to provide permanent lubrication of the stem thrust collar. Exceed AWWA specifications.

Permanent, leakproof joints may be quickly made with just a wrench even in the worst weather. No calking is necessary! The resulting bolted connection is flexible enough to permit deflection in any direction, expansion or contraction, and to absorb vibration — all without leakage! Suitable end gaskets allow a valve of nominal size to be installed on any AWWA class of cast iron pipe.

All Mueller Gate Valves feature Mueller's exclusive "four point contact" disc wedging mechanism and are fully bronze mounted. On special orders, valves will be furnished with all-bronze disc and disc wedging mechanism.

For additional information, consult your Mueller Water Works Catalog W-96 or your Mueller representative.

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

Get full details of this month's products . . . mail your Readers' Service card today.

To order these helpful booklets check the coupon on page 32.

Safe-T-Cones Solve Traffic Problems Night and Day

222. For data on Safe-T-Cones, the all-rubber traffic guides available in two sizes, 18" and 28"—painted or reflectorized for day and nightime use—get bulletin from Radiator Specialty Co., Charlotte, N. C. Information included on Safe-T-Signs which add greatly to value of markers. Check the coupon now!

Hot or Cold Patching Mixtures Prepared on the Job

304. By preparing your patching mixtures, hot or cold, right on the job, you can use them immediately with a minimum of handling. Get full data on the McConnaughay Model HTD "Multi-Pug" Asphalt Mixer for fast, easy and economical preparation of patch materials. Write K. E. McConnaughay, Layfette, Ind. or use the coupon.

Think of Aerial Surveys When You Need Maps

311. Every engineer and public official should investigate aerial surveys for maps of new areas, up-to-the-minute maps for city planning, highway relocation, surveys to plan extensions of sewers, water mains and utilities. Precise contours for topographic maps and other data in any detail desired can be furnished by Aero Service Corp., 236 Courtland St., Philadelphia 20, Pa. Interesting booklet on aerial mapping services and methods available by checking the coupon.

Versatile Road Wideners Improve Highways at Low Cost

374. In illustrated bulletins describing Apsco road wideners and base pavers you will find full data on two versatile pieces of road-building equipment that will help you hold down costs while bringing old roads up to present day standards. Get the full story today by checking the coupon or write to Blaw-Knox Equipment Div., Blaw-Knox Co., Pittsburgh, 38, Pa.

Weed Killing Case Histories

26. Low cost weed and grass control with Du Pont "Telvar" W weed killer is demonstrated by full-color photographs in a new booklet issued by Grasselli Chemicals Dept., E. I. Du Pont de Nemours & Co., Inc., Wilmington 98, Del. Text includes application methods for best results. Check the coupon for your copy.

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the coupon.

Uniform Salt and Cinder Spreading at All Speeds

93. Be sure to investigate the hydraulically operated ground drive offered by Baughman to give you the advantages of two drive speeds and uniform distribution of material regardless of truck speed, but without the need for power takeoff or transmission. Full data on this and many other features in Form A-380. Baughman Mfg. Co., Jerseyville, Ill.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. PW, Warren, Ohio.

Better Highways Through Salt-Soil Stabilization

162. Practical information for the men who build, repair and maintain our highways is provided in two bulletins issued by the International Salt Co., Inc., Scranton, Pa. General principles of salt-soil stabilization, applications, plant mix and road mix are described. Check the coupon for your copies.

Cut Road Building Costs With A Tamping-Leveling-Finisher

175. For a full description of roadbuilding methods with a tamping-leveling-finisher which lays a smooth mat without forms, tamping and compacting to desired grade, get Bulletin 879-A from Barber-Greene Co., Aurora, Ill. Check the coupon today.

Portable Melting Furnace For Rubberized Joint Sealers

213. The Hauck double jacketed melting furnace uses L-P gas as fuel and a high flash point oil for heat transfer to assure close temperature control when melting rubberized joint sealers of all types. All details on this 16-gallon capacity unit are furnished in Bulletin 1081. Check coupon for your copy. Hauck Mfg. Co., 124 10th St., Brooklyn 15, N. Y.

●

REFUSE COLLECTION AND DISPOSAL

Sanitary Landfill Operation and Methods

28. The location and area requirements for sanitary landfill, operation methods for trench type and area fills, equipment selection and costs are items discussed in an 8-page booklet issued by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. Be sure you have this reference when considering the problem of garbage and refuse disposal. Check the handy coupon today.

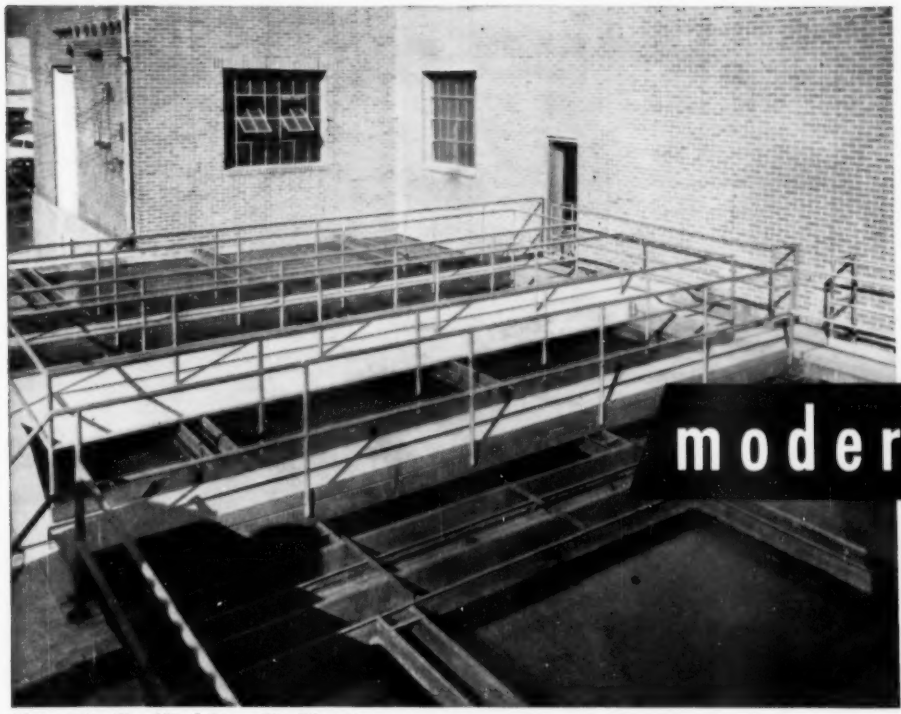


Photo courtesy City of North Kansas City, Missouri

HOW NORTH KANSAS CITY modernized ITS IRON REMOVAL PLANT

TO *triple* the 1912 rate of an old-fashioned settling basin and two filters could be a problem—and quite expensive.

Consulting Engineer Charles A. Haskins, solved it very economically. Two compact, modern Permutit Precipitators were built into the *old* settling basin. Operating on the highly efficient sludge-blanket principle, these Permutit Precipitators assure maximum operating economy.

The results of this modernization—detailed in the table below—speak for themselves:

- Total Iron reduced from 5.0 to 0.1 ppm.
- Manganese reduced from 0.2 ppm to essentially zero.
- Turbidity reduced from 50 to only 3 ppm—permits 19 hour per day filter runs with washing only once every 5 days!
- Hardness reduced to level desired.

For full details on the Precipitator write to THE PERMUTIT COMPANY, Dept. PW-6 330 West 42 St., New York 36, N. Y., or to Permutit Company of Canada, Ltd., 6975 Jeanne Mance St., Montreal.

Registered Trade Mark

Water Analysis Report Before and After Conditioning

			PPM as	Raw Water from wells before aeration	Precipitator effluent (unfiltered)
CATIONS	Calcium	$(Ca++)$	$CaCO_3$	145	55
	Magnesium	$(Mg++)$	$CaCO_3$	103	75
	Sodium	$(Na+)$	$CaCO_3$	108	105
ANIONS	Bicarbonate (Alkalinity)	(HCO_3-)	$CaCO_3$	190	42
	Carbonate (Alkalinity)	(CO_3--)	$CaCO_3$	0	24
	Hydroxide (Alkalinity)	$(OH-)$	$CaCO_3$	0	0
	Chloride	$(Cl-)$	$CaCO_3$	35	35
	Sulfate	(SO_4--)	$CaCO_3$	146	139
	Total Hardness		$CaCO_3$	248	130
	Alkalinity A (Methyl Orange)		$CaCO_3$	190	66
	Alkalinity B (Phenolphthalein)		$CaCO_3$	0	12
	Free Carbon Dioxide		CO_2	16	0
	IRON (total)		Fe	5.0	0.1
	Silica		SiO_2	16.8	13.0
	MANGANESE		Mn	0.2	0.0
	TURBIDITY (after shaking)			50	3
	Fluorides		F	0.5	0.4
	Color			Turbid	5
	pH			7.3	9.5
	Total Hardness (as $CaCO_3$)		Result in grains per U.S. Gal.	15	7.6

WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS...

PERMUTIT®

To order these helpful booklets check the coupon on page 32.

Efficient Landfill Operations For Small Communities

349. Step-by-step photos and concise text are used in a bulletin of the Oliver Corp., to show the construction and operation of a sanitary landfill, using equipment especially suitable for the smaller community, the Oliver OC-3 Tractor-Loader. Besides providing economical refuse disposal, many other jobs handled by this unit are suggested. For a copy, write to the Oliver Corp., 400 W. Madison St., Chicago 6, Ill. or check the coupon.

How to Reduce Refuse Collection Costs

123. The sequence of operations for fast loading and refuse compaction in the Gar Wood Load-Packer are illustrated and described in 12-page folder W-110, together with size data and details of hydraulic elements. Be sure to check all details of the efficient Load-Packer system. Check coupon or write Gar Wood Industries, Wayne Division, Wayne, Mich.

TRAFFIC SIGNS

How Reflective Sheeting Improves Traffic Signs

157. Get full data on Grotelite reflective sheeting for smooth, brilliant, long-life traffic signs and marking devices from the Grote Mfg Co., Bellevue, Ky. Use the handy card or coupon today.

Permanent Signs and Markers For All Purposes

345. Permanent cast aluminum street signs and markers of all types are described in a 32-page illustrated booklet available from Lake Shore Markers, 654 West 19th St., Erie, Pa. Get full information on these distinctive markers, furnished in lifetime aluminum, plain or reflectorized finish, by checking the coupon.

Get This Helpful Sign Manual

367. Detailed information on all classifications of National Standard Signs for control of traffic, street identification and other purposes, together with a complete line of accessories is presented in a convenient Sign Manual by Lyle Signs, Inc., 2720 University Ave., S.E., Minneapolis 14, Minn. For a copy, check the coupon.

WEED CONTROL

Chemical Weed Killers Are Fast and Effective

117. Be sure to check Polybor-Chlorate and Concentrated Borascu for fast economical non-selective destruction of weeds and grasses. Features and applications of these effective products are outlined in bulletins available from Pacific Coast Borax Co., 630 Shatto Pl., Los Angeles 5, Calif. Check coupon for full data.

What You Should Know About Chemical Weed Control

132. In a convenient 44-page book, the C. B. Dolge Co. gives full details on spraying procedures and chemicals to use for control of lawn and roadside weeds, ragweed eradication and insect control in turf. Get your copy by checking the coupon or write C. B. Dolge Co., Westport, Conn.

CIVIL DEFENSE

Get the Facts on Air Raid Sirens

86. There's more to be considered in air raid warning sirens than the loudness of the signal. Get complete information on efficient size and spacing of sirens from Federal Sign and Signal Corp., 8733 So. State St., Chicago, Ill., by using coupon.

Does Your Water Works Have Standby Power?

224. Dependable Climax power plants are ready for emergency service to insure fire protection, and can also save power costs by peak load operation. Use the coupon for full data on Climax, 40 to 495 HP, operating on sewage or natural gas, butane or gasoline. Climax Engine & Pump Mfg. Co., So. La Salle St., Chicago 3, Ill.

INSECT CONTROL

Investigate "Tifa" For Insect Control

45. With "Tifa", the Todd Insecticidal Fog Applicator, chemicals for insect control are distributed as a true, clean fog which effectively penetrates all spaces where insects may hide. For full data on the use of this machine in public health programs, write Combustion Equipment Div., Todd Shipyards Corp., 81-16 45th Ave., Elmhurst, N. Y., or use the coupon.

STREET LIGHTING

Better Lighting For Shopping Centers

245. Economy and good appearance are combined in the Union Metal Monotube Poles specifically designed for shopping center parking lots. Typical installations, various pole designs and bracket arrangements are shown in Folder LS-15, issued by Union Metal Mfg. Co., Canton 5, Ohio. Check the coupon.

Why do public bodies *prefer* PAYLOADER® TRACTOR SHOVELS?

compare these two items

ORDINARY TRACTOR SHOVEL

¾ Yd. [redacted] tractor shovel, nearly new, used only 4 mo's. Will sacrifice for half price. Phone [redacted]

The above newspaper classified ad appeared in March, 1954.

PAYLOADER TRACTOR SHOVEL

Top price at the Auction Sale among used tractor shovels was for a HOUGH Model HF "PAYLOADER", 2½ years old, which brought 68% of its original price. The unusually high price came as a complete surprise to even the auction officials.

The above report appeared in an April, 1954 publication.

Wise tractor-shovel buyers know there's more value in a "PAYLOADER" when it's new and that it'll bring more when they sell it. They know that The Frank G. Hough Co. has pioneered MORE developments and MORE improvements in tractor-shovels than all other manufacturers put together.

Further proof of "PAYLOADER" value is evidenced by the fact that you will seldom find a *used* one for sale — even though more "PAYLOADER" machines have been built than all other makes of unit-design tractor-shovels combined.

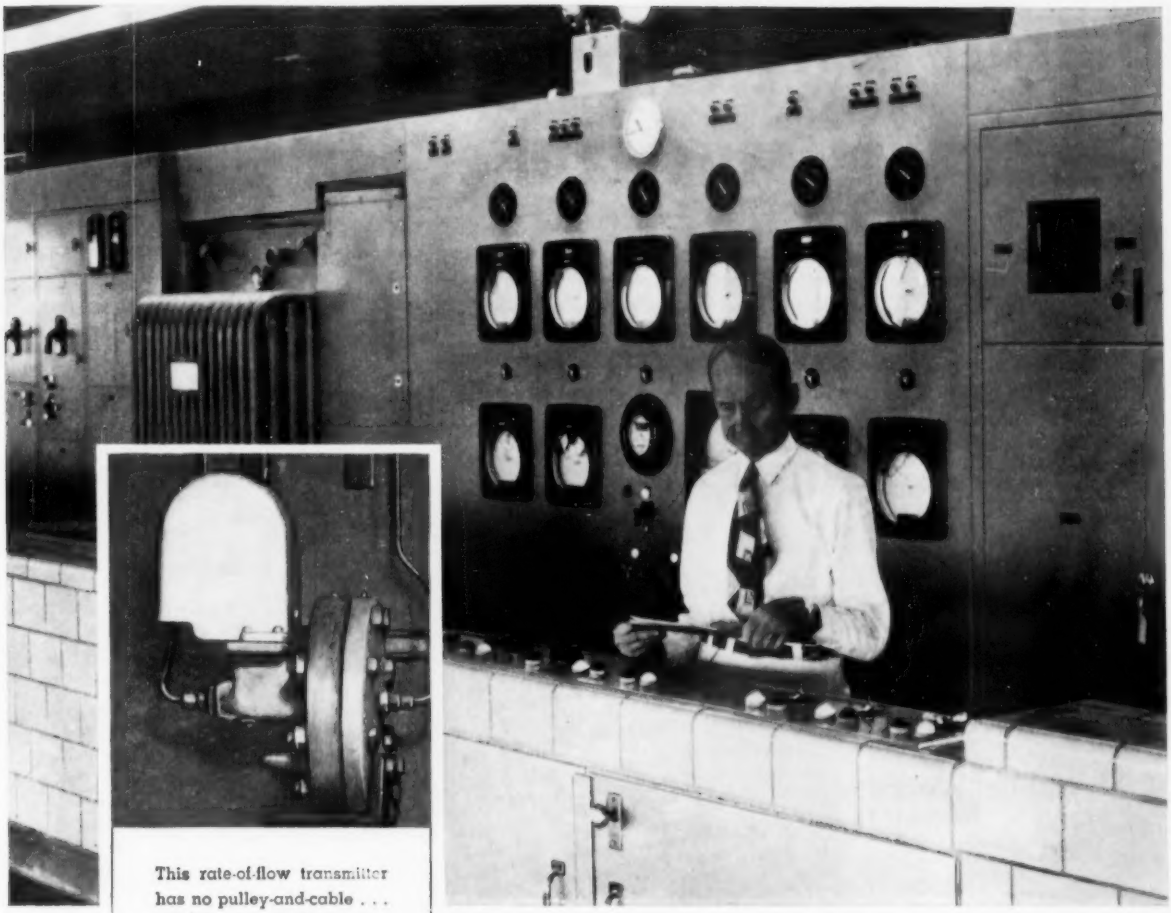
So, when you want maximum value and PROVEN PERFORMANCE in a tractor-shovel, you'll be wise to buy a "PAYLOADER". A complete range of sizes and models from 12 cu. ft. to 2 cu. yd. bucket capacity. Your nearby "PAYLOADER" Distributor is ready to serve you. The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Illinois.

This is a Model HF "PAYLOADER" tractor-shovel like the one that brought top price in the Auction Sale quoted above.

You can't compete if your equipment is obsolete.

PAYLOADER®
THE FRANK G. HOUGH CO. Since 1930

Now's the time to mail this month's Readers' Service card.



This rate-of-flow transmitter has no pulley-and-cable . . . can't be damaged by over-ranging . . . uses no mercury.

At the St. Louis County Water Company's new $1,500,000 filter plant, Hine, Mo., d/p Cell Flow Transmitters tap differential pressure from venturi tubes in effluent lines of 6 filter beds . . . transmit flow measurement to bank of 6 M/40 Controllers shown on panel above. Controllers hold filtration rates at pre-set control points. Other Foxboro instruments on panel indicate loss-of-head and backwash rates.

Smoothest-working "TEAM" you can get to control filter rates

Here's an unbeatable team for filter rate control . . . a Foxboro d/p Cell* Transmitter . . . an M/40 Controller . . . and a butterfly valve. It costs less to install and less to maintain!

The d/p Cell Transmitter has no pulley-and-cable to get out of calibration . . . no mercury. It detects flow pressure differential across its tough metal diaphragm . . . is unaffected by backwash and sand. The Controller maintains flow at exact pre-set flow rates . . . keeps filtration in perfect balance with pre-treatment and delivery. The rubber-lined valve provides both flow control and tight shut-off.

Find out how this reliable combination can cut maintenance costs and step up efficiency in your plant. Write for complete information.

*Trademark

THE FOXBORO COMPANY, 246 NORFOLK ST., FOXBORO, MASS., U. S. A.

FOXBORO
REG U S PAT OFF

FLOW CONTROL INSTRUMENTATION

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

Detroit tests prove interesting facts about refuse collection units

Like a lot of other cities — Detroit, Mich., suddenly discovered that it had "*outgrown*" its sanitary system. Old methods and machines simply were *no longer adequate* to handle the vast new responsibilities imposed on them. So wise public officials acted promptly to provide modern rubbish disposal for Detroit's *500,000 homes and commercial establishments*. They studied the sanitation problem from every angle . . . made detailed "route tests" with every type of collection equipment. Result: the City of Detroit *ultimately purchased 453 Gar Wood Load-Packers* . . . a pretty good indication that Load-Packers are the best buy for your community, too. Contact your Gar Wood distributor today for complete details and a *free Load-Packer demonstration*.

Here's what

CARL D. WARNER

Commissioner

of Public Works

REPORTED . . .

Conclusions excerpted from a detailed article appearing in THE AMERICAN CITY Mar. 1954

"*In order that we standardize on the best possible equipment for our needs, the department's Motor Transport Division and the Division of Sanitation were asked, jointly, to conduct exhaustive tests of the various makes and types of equipment.*

"To approach this task from a scientific angle, we decided to *analyze the composition of normal loads.* Several thousand truck-loads of rubbish were separated and examined. From this study, we learned that *82% of all rubbish collected was burnable and could be sent to the incinerators.* Furthermore, since burnable materials are normally more bulky than nonburnable, our problem was one of *bulk rather than weight* . . .

"This automatically narrowed our choice of new collection equipment. *Trucks had to be equipped with fully enclosed, compaction-type bodies, able to reduce these compressible wastes into a solid, dense mass and thereby increase the load capacity.* Open trucks, certainly, were obsolete.

"Too, normal city expansion was moving our landfill operations to more remote locations. Thus, the greatly increased capacity of packing type bodies would substantially reduce number of trips to the dump.

"Experiments with various body designs further narrowed the field. Some types were found to be impractical in the narrow downtown alleys. Others, bulky in design, presented problems of maneuverability; some with complicated operating mechanisms presented hazards to safety.

"These extensive tests conducted by the Sanitation and Motor Divisions in conjunction with the manufacturers of packing-type units resulted in our decision to purchase 16-yard *Gar Wood* Load-Packers. *The powerful compaction, neat and orderly design, and low loading height, as well as simplicity and speed of operation, proved ideal for our work.* Today, we have 423 of these units in operation and 30 additional units scheduled for delivery."

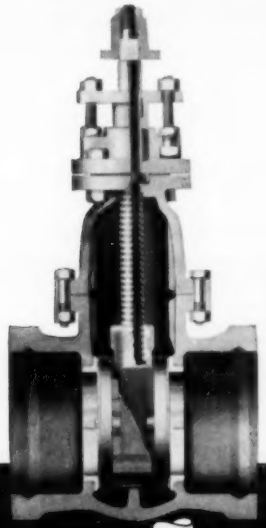
453 Gar Wood Load-Packers now provide sanitary, low-cost rubbish disposal weekly over Detroit's 4200 miles of streets and alleys, to 4 incinerators and 7 sanitary landfills.

LP-1

GAR WOOD INDUSTRIES, INC. Wayne Division — Wayne, Michigan; Richmond Division — Richmond, Cal.

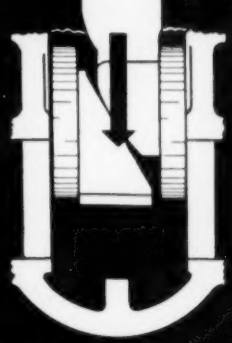
WORLD'S LARGEST MANUFACTURER OF DUMP BODIES AND HOISTS FOR TRUCKS AND TRAILERS

Now's the time to mail this month's Readers' Service card.

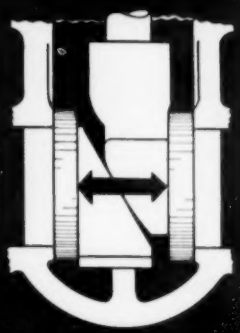


Look how you gain LONGER, TROUBLE-FREE VALVE LIFE

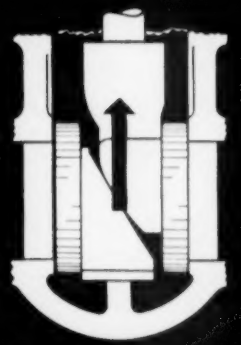
with Darling revolving disc gate valves*



DESCENDING. Fully revolving discs, independently hung, change seating position at each closing, assuring uniform wear distribution for prolonged service. Plain "no pocket" discs are interchangeable for *extra* life!



CLOSED. Faces of upper wedge are radiused and faces of both wedges are transversely beveled for equalized wedging pressure and *tight closing despite valve body distortion.*



RISING. Wedging pressure on both discs is released before discs start to rise. Complete absence of wedging pressure during travel of discs assures easy operation, tight closing and greatly prolonged valve life!

***DARLING REVOLVING DISC GATE VALVES FOR EVERY NEED.**

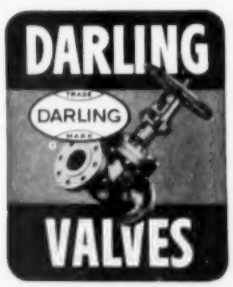
These unique Darling valves are available in a broad range of sizes and types, manually or motor operated, for all normal or unusual services. Before you invest in *any* valves, find out what you stand to gain by using the proper Darling valves on your job. Simply outline your service needs for specific data . . . or . . .

ASK FOR BULLETIN No. 5002

DARLING VALVE & MANUFACTURING CO.

Williamsport 22, Pa.

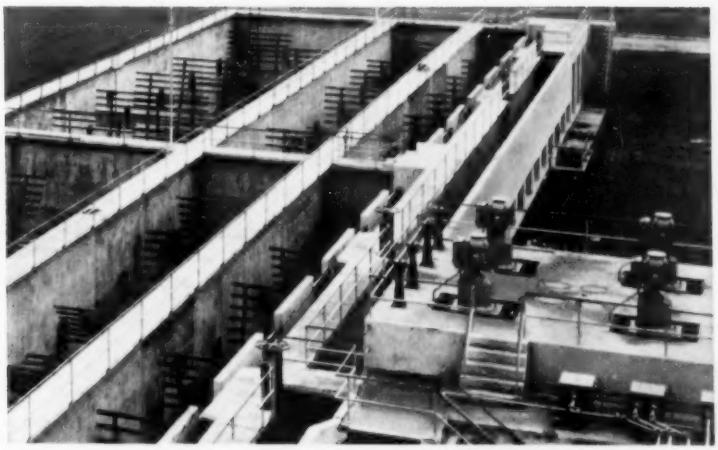
Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario



FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

Get full details of this month's products . . . mail your Readers' Service card today.

Fast-growing Houston called on JEFFREY for dependable water treatment equipment



Jeffrey sanitary engineering and equipment can be applied effectively to any American city with "growing pains and a thirst."

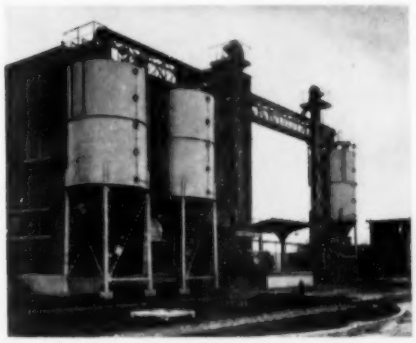
Jeffrey's broad experience in the design and construction of sanitation systems covers all types of installations. You can turn your sanitation problem over to Jeffrey with complete confidence.

Hundreds of water, sewage and industrial waste plants throughout the nation are now Jeffrey-equipped. The complete Jeffrey line for Water Treatment Plants includes:

- Bar and Disc Type Screens
- Screenings Grinders
- Grit Collectors & Washers
- Sludge Collectors
- Sludge Elevators
- Scum Removers
- Power Transmission Machinery
- FLOCTROLS
- Dry Feed Chemical Machines
- Biofiltration Plant Equipment
- Garbage Grinders
- Belt and Spiral Conveyors
- Bucket Elevators
- Chains and Sprockets

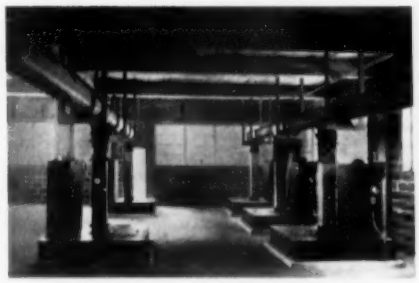
Write for Catalog 833-A

Below: A complete chemical handling system utilizing Jeffrey Power Scoop, Spiral Conveyors and Bucket Elevators. Material flows uninterrupted from cars to storage bins or chemical feeders.

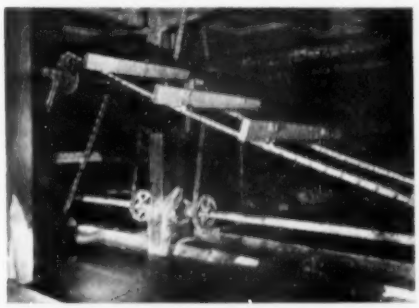


At left: 14 Jeffrey FLOCTROLS, each 54' long, driven by 1½ hp. motor, have peripheral paddle speed of 1.2 to 1.8 ft. per second . . . 45-minute detention at 80 mgd. Note four Jeffrey Rapid Mixers at right.

Below: Jeffrey Spiral Conveyors carry chemicals from storage bins by bucket elevators to chemical feeders.



Below: Close-up of Jeffrey Sludge Collectors in action in the settling tanks of Indianapolis Water Co.'s White River plant.



THE JEFFREY MANUFACTURING CO.

ESTABLISHED 1877

Columbus 16, Ohio

sales offices and distributors in principal cities

PLANTS IN CANADA, ENGLAND, SOUTH AFRICA

IF IT'S MINED, PROCESSED OR MOVED . . . IT'S A JOB FOR JEFFREY!

New Attraction
on Atlantic City's Boardwalk

HY-LITE Lighting Standards

▲ BEFORE

◀ AFTER

Now referred to as the "Great Light Way", Atlantic City's Boardwalk boasts 123 Spun-Crete Hy-Lites which recently replaced old style poles. Hy-Lite Standards, and fluorescent-mercury units mounted on concrete brackets, combine to offer the latest advancement in modern street lighting.

ATTRACTIVE Hy-Lite Lighting Standards are a bright attraction assured of a long "run" on Atlantic City's famous Boardwalk.

In conjunction with Atlantic City's Centennial Celebration and the Diamond Jubilee of Light, economical Hy-Lites have been installed to replace obsolete lighting standards.

These Hy-Lites successfully combine *prestressing* with the Spun-Crete process to provide —prolonged freedom from internal corrosion, minimum contraction or expansion under extreme temperature changes, and a durable water-polished granite standard completely immune to salt water corrosion.

Available in various designs, Hy-Lites meet *any* street lighting need and contribute to attractive street appearance while requiring virtually no maintenance whatever. Write today to the American Concrete Corporation, 5092 North Kimberly Avenue, Chicago 30, Illinois, for information regarding the latest *prestressed* Spun-Crete designs.

American Concrete

PRESTRESSED CONCRETE LIGHTING STANDARDS

Now's the time to mail this month's Readers' Service card.

RAW WATER

Is Best Tamed By a Superior COAGULANT...

TENNESSEE CORPORATION
Ferri-Floc
FERRIC SULPHATE

Whatever your specific water treatment problem may be, you can figure on Ferri-Floc to do the job adequately and efficiently. A partially hydrated ferric sulphate, Ferri-Floc is a stable, free flowing, granular salt which can be fed with few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy and safe handling as well as storage in closed hoppers over long periods of time.

- **Rapid Floc Formation.**
- **PH correction.**
- **Taste and odor control.**
- **Color removal.**
- **Softening.**
- **Ease of operation.**
- **Bacterial removal.**
- **Manganese and Silical removal.**
- **Turbidity removal.**
- **Economy.**

Water Treatment
Ferri-Floc coagulates surface or well waters, and it aids taste and odor control. It is effective in lime soda-ash softening, and is adaptable to treatment of practically all industrial water or wastes.

Sewage Treatment
Ferri-Floc coagulates waters and wastes over wide pH ranges. It provides efficient operation regardless of rapid variations of raw sewage, and is effective for conditioning sludge prior to vacuum filtration or drying on sand beds.

COPPER SULPHATE

COPPER SULPHATE will control about 90% of the microorganisms normally encountered in water treatment plants more economically than any other chemical.

SULPHUR-DIOXIDE SO_2

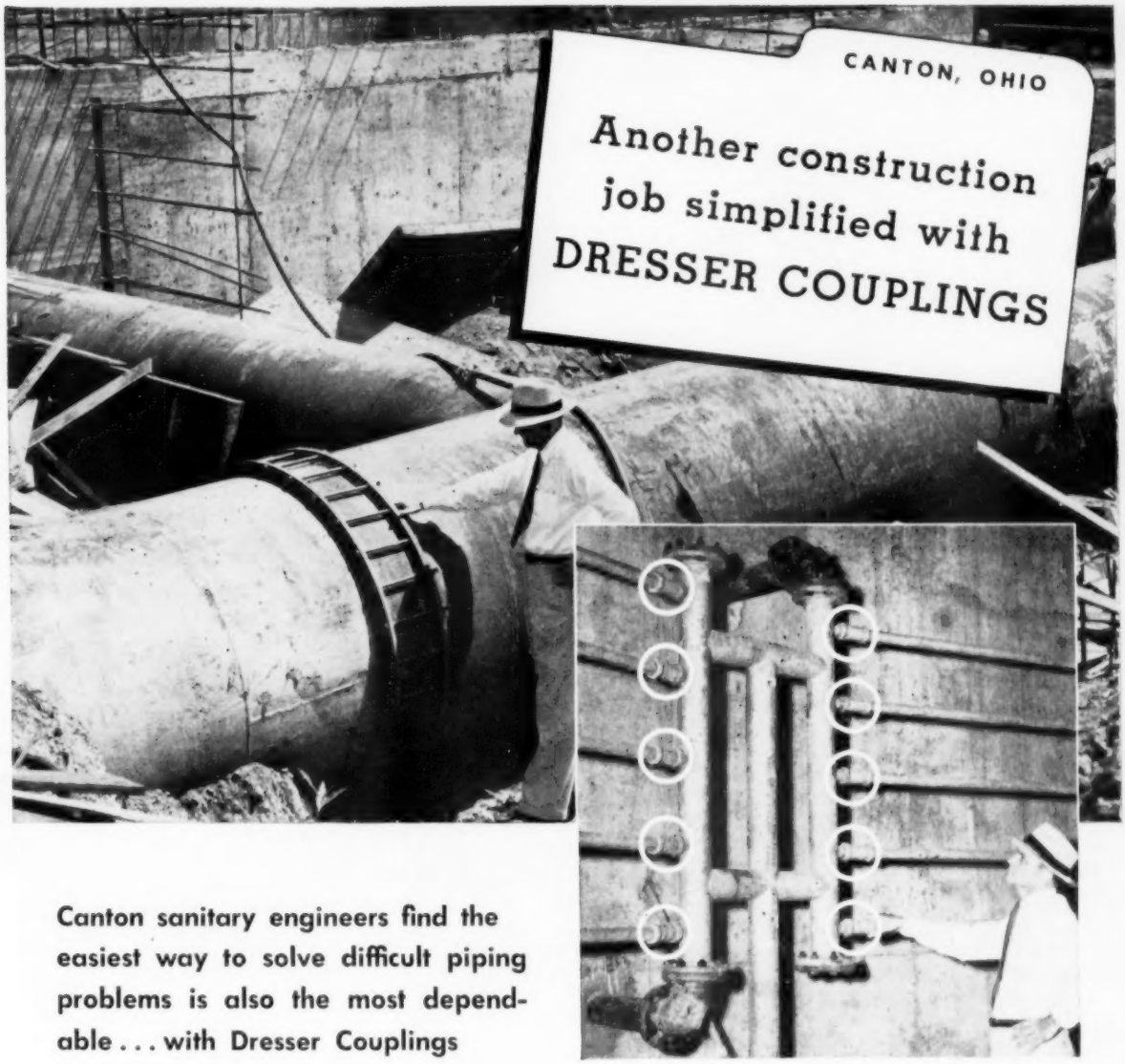
SULPHUR-DIOXIDE is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.

Free Literature! Samples, Specifications and Detailed Information on Request.

TENNESSEE CORPORATION

617-29 Grant Building, Atlanta, Georgia

Get full details of this month's products . . . mail your Readers' Service card today.



Canton sanitary engineers find the easiest way to solve difficult piping problems is also the most dependable . . . with Dresser Couplings

One of the construction problems at Canton, Ohio's Sewage Treatment Plant was installation of a special welded tee on the effluent line between grid house and primary tanks.

The use of 54" Style 38 Dresser Couplings made the installation relatively simple. Workmen, with a minimum of skill and heavy equipment, quickly made permanently tight Dresser joints.

Recognizing the many applications for versatile Dresser Couplings throughout the plant, Canton engineers greatly simplified tough, close-quarter piping installations.

Write today for more information on how Dresser Couplings can save *you* time and money on water, sewage and industrial waste projects.

Hot water heating coils completely encircle the interior walls of six large digester tanks in the Canton Plant. 450 Dresser Style 65 Compression Couplings were used to absorb expansion-contraction of piping and to simplify close-wall installation.

DRESSER® COUPLINGS

Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: Toronto, Ont.

Now's the time to mail this month's Readers' Service card.

"WE CAN EXPECT THE MOST FOR OUR DOLLAR"

J. C. COUGHLAN, Supt., Dist. No. 3
Nevada County, California

Up in the old-time gold mining country of California, Nevada County has 111 miles of hilly roads to maintain. Cat® equipment does the job.

The D8, with No. 8A Bulldozer, shown above, is widening and straightening a mile-long stretch of road where logging trucks and sharp curves had caused a traffic hazard. This big yellow tractor does most of the heavy pioneering and rough grading, as well as clearing a lot of snow in winter. In addition the district uses a Caterpillar No. 12 Motor Grader and an HT4 Shovel.

Superintendent Coughlan says: "We have found Cat equipment the best that can be owned. Our D8 has operated nearly 5000 hours without any major repairs — all in rough country. The same goes for all our Caterpillar machines. We can expect the most for our dollar out of them."

Like all Caterpillar units, the D8 is built with extra ruggedness to stand up under tough conditions and deliver years of trouble-free work. Your Caterpillar Dealer backs its long life with prompt, reliable service and genuine parts. Ask him for an on-the-job demonstration and solid proof that the machines he sells can save money for your taxpayers.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR®

Chemical Weed and Brush Control by Contract

SIGHT of a tank-mounted International motor truck, with driver seated unconventionally on the right in sole control of a roadside spraying operation, was common last year along stretches of highways in New York state. Five identical units, fitted with chemical spray equipment and custom controls, applied herbicides to both sides of several thousand miles of the state's traffic routes. Unwanted weeds and brush along roadsides and at curves, crossroads, culverts and guard rails were sprayed three times between May and October.

Jointly responsible for the inexpensive and convenient method of vegetation control so effectively proved in New York were Robert, John, Paul and Raymond McMahon, Binghamton, N. Y., brothers. Climaxing extensive study of the possibilities of killing weeds and brush by means other than manual cutting, the four developed a vehicle that may become the universally accepted method of cleaning up areas near highways.

A single operator performs the multiple functions of driving and handling four spray nozzles. The sprays for combating vegetation are distributed through adjustable, fan-type nozzles from a stack attached to the front bumper. A conveniently-located pistol-grip control in the truck cab avoids the need for a spray operator. Easily removable nozzles, capable of spraying to any desired depth up to 60 feet, can be activated either jointly or individually. The design assures accurate control to prevent spray drift.

Trucks of the McMahon fleet are 154-inch wheelbase models powered by 130-horsepower gasoline engines. They are equipped with two-speed rear axles and five-speed transmissions. Tandem tanks, separated by a double bulkhead, are 150-gallon for chemical compound and 1,000-gallon capacity spray tank. Each truck is fitted with a three-speed power takeoff for pump operation. Chemical, 2,4-D (2,4-Dichlorophenoxyacetic acid) and 2,4,5-T (2,4,5-Trichlorophenoxyacetic acid), is pumped to the spray tank, then is mixed with water and the solution is jet agitated. The tank, can be filled from any source, with water pumped into the container through 25 feet of two-inch refilling hose.

In addition to their use for weed control, McMahon's trucks can be used also for spraying calcium chloride on dirt roads or fertilizer on roadsides; and for controlling hard-to-kill vegetation off roadsides.

During the New York spraying experience, each truck proved capable of covering both sides of a 25-mile stretch of highway in a single eight-hour day. Last year's three-sprays-per-season job—which

● **RIGHT hand truck drive facilitates one man operation.**

● **SPRAYS under control of driver cover entire roadside.**

Photos courtesy International Harvester Co.

started three-year contracts with various highway governing bodies—was completed at a charge of $29.50 per mile per season. Though crops are known to be sensitive to weed and brush killers and may be adversely affected by spray drift, initial use of the McMahon equipment occasioned no damage claims. This is attributed to care in the training of men and to the excellent equipment.

Another conclusive result of the New York spraying was evidence that chemicals, properly applied, do not kill grass or sterilize the soil. With weeds and brush removed grasses become better established and form a good turf, reducing erosion hazards and making it difficult for new, unwanted vegetation to get started.

Weed and brush control operators must know what weeds grow in the spring, summer and fall, when they germinate and when they seed. The leaf must be sprayed to kill the plant. By calculating when the early weeds go to seed and the next crop germinates, both sides of a 600-mile strip of road can be sprayed with one piece of equipment, getting all the spring weeds before they go to seed. Then the truck goes back to the start of the run to destroy the next crop of weeds before it is high enough to be mowed. A third spraying is completed late in September on the final crop of weeds. The McMahon long-range program contemplates three seasonal sprayings per year for three years. Thereafter, fewer sprayings are required if a strong, weedless turf has been established along the roadside.

"A single spraying is not to be considered at all," McMahon cautions, "and we dismiss the idea of more than three sprayings per year since we have already determined that such frequency does the job reasonably well." The system of repeated weed spraying is also necessary for brush. No single spraying will kill all species and it is unlikely it will kill all plants of the same species. Some plants, such as ash, require several sprayings. Others, apparently dead, often produce new shoots from the unkilled portions of their root systems. Where large woody growth is sprayed, it is done progressively "merely in passing." This stops further encroachment and avoids heavy "browned-out" appearance. If the growth is too large to fall by itself, or if its falling would present a hazard to travel, it is not sprayed. Brush that is an inch or more in diameter is left to be cut later. The practice of cutting the larger vegetation and treating the remainder with a spray is a significant change in brush control.

Herbicides have been used, up to the present time, largely to control woody growth, while weeds have been neglected. This has resulted in a "brown-out," the source of most of the complaints concerning the use of herbicides. The current emphasis is on the use of chemical sprays to kill weeds and to prevent future growth. The "brown-out" is consequently avoided.

McMahon Brothers does the three-season spraying job on a volume of 3,500 road miles for the run of the contract in each separate state or operating area. This brings to 21,000 the total mileage sprayed per season in each such area. Since McMahon's trucks move along at a faster rate than a conventional mowing machine and require much less maintenance, the savings that accrue through spray application can be used in other branches of highway development. Equally important is the fact that instead of merely cutting down unwanted growth, chemical treatment kills it.

In addition to its salutary effect upon highway safety, the system holds out hope for hay fever sufferers. Since it has been determined that up to 65 percent of all ragweed grows on rural roadsides, chemical spraying by truck can be an important factor in pollen control.

• • •

Steam Cleaner Used on Safety Islands

C. R. REA,
Sup't. Of Street Cleaning,
Kansas City, Mo.

Before we had our steam cleaner, we cleaned safety islands with cold water, with a detergent added, using labor to scrub the dirt from the painted section of the island. We averaged cleaning ten islands a day, using two flushers and ten men.

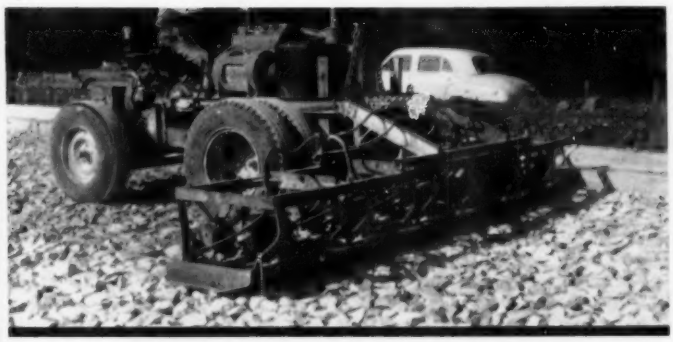
We now use one flusher with our Malsbary steam cleaner and, with three men, do a thorough cleaning job on 12 to 15 safety islands a day. The saving in labor alone is $75 a day for the two-week period in the spring when these islands are cleaned of the winter accumulation of dirt and grime.

Our steam cleaner is also used to clean truck motors before putting them in for overhaul. Any equipment that is overheating as a result of dirt accumulation on the motors is also steam-cleaned. The garbage trucks operated by the Public Works Department are steamed twice a week.

Wear White at Night for Greater Safety

A large metropolitan police department made a check of the clothing worn by pedestrians killed in traffic at night. About four-fifths of the victims were wearing dark clothes and one-fifth light colored garments. This study points up the rule that pedestrians are less likely to encounter traffic mishaps at night if they wear or carry something white after dark so that drivers can see them more easily.

● DISTRIBUTING asphalt and stone when building penetration macadam base.



● CONSOLIDATING large stone in the base by vibration.

● SPREADING base course stone over macadam subbase.

MODERN MACADAM PAVEMENT

Chosen for Heavy Duty Expressway

FRED SWINEFORD,
Macadam Pavements, Inc.,
Columbus, O.

IN the construction of the extension of the Olentangy River Expressway, which runs through downtown Columbus, O., a heavy-duty macadam surfacing was selected to withstand the heavy traffic this expressway carries. The section now under construction continues the 4-lane divided highway for 2.3 miles to Henderson Road. There are four traffic lanes, with a raised median divider 20 ft. wide. The width of each pair of lanes is 25.5 ft.; intersections are channelized and illuminated; and there are acceleration and deceleration lanes. The shoulders are surfaced with crushed stone, graded from 1-inch to fines; and are 6 inches thick at the edge of the pavement, tapering to 2½ inches at the outside edges.

The new pavement consists of 3 inches of dense-graded, hot-mixed asphaltic concrete laid in 2 courses over 3 inches of emulsified asphalt penetration macadam. Under this there are 5 inches of big stone, water-bound macadam, compacted, filled and bound into a monolithic base course. The subbase is 6 inches thick and consists of crushed rock graded from 2½-in. to dust.

With this type of layer construction each successive course becomes truer to crown and profile so that the end result produces a perfect riding, non-cracking pavement without objectionable joints. Furthermore, the 3-inch layer of bituminous macadam provides an excellent bond between the water-bound macadam base and the asphaltic concrete top.

Modern specifications and the latest type of road building equipment were used in the construction of the expressway. The stone for the macadam was spread by a long wheel-base All-Purpose spreader which lays the stone true to crown and profile. Compaction was effected by means of the new Jackson vibratory compactor which not only vibrates the stone into place but effectively jars the screenings down to fill the voids in the bigger stone. The vibratory compactor is followed by 12-ton rollers which key and compact the upper part of the base course. The asphaltic concrete was spread with a Barber-Greene paver and compacted with 3-wheel, 10-ton and 2-wheel, 8-ton rollers.

The unit cost of the 17-inch thick pavement, including the 3-inch asphaltic concrete top, the 3-inch bituminous penetration macadam intermediate base, the 5-inch water-bound macadam base and the 6-inch granular subbase, was $4.03 per square yard. Traffic was maintained throughout construction, first on the old 2-lane pavement and later on the 2 lanes of the new pavement.

The project was designed and supervised by Franklin County Engineer, Guy Elbin. Ed Bischoff is chief deputy and Bob Koerner, engineer in charge of construction. Ted Wallace was project engineer on the job, which was financed jointly by Franklin County and the Federal Bureau of Public Roads. August Shofer, Columbus, Ohio, is District Engineer for Public Roads. The State Highway Department, under the direction of S. O. Linzell, approved the plans and let the contract.

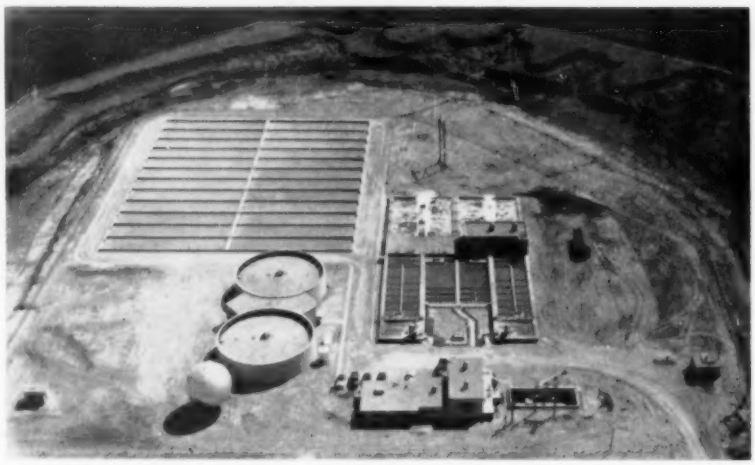
Contract work was done by R. J. Dienst and Son, Columbus, Ohio. Limestone for the base course and the asphaltic concrete were furnished by Marble Cliff Quarries Co., Columbus, Ohio. American Bitumuls and Asphalt Co., Columbus, Ohio, furnished the emulsified asphalt for the penetration course, and the Standard Oil Co. of Ohio furnished the asphalt cement for the asphaltic concrete.

SEWAGE TREATMENT and A SIGN OF

STORM sewers, more sanitary sewers and a new activated sludge type sewage treatment plant have been constructed for Enid, Okla., during the past year. These "Signs of Progress" as they have been termed by Gerald E. Wilkins, City Manager, are the visible evidence of Enid's rapid growth and development.

The storm drain program, needed because even moderate rains flooded some areas, involved 40,000 ft. of storm sewers up to 72 inches in size, 209 inlets and 125 manholes. Reinforced concrete pipe was used for lines over 24-inch. Many obstacles were encountered in construction, including an abandoned oil well from which the top 12 ft. had to be removed and the stub capped to prevent discharge of salt water. One section of 66-inch line was laid 22 ft. below the natural ground surface. Suddreth Construction Co. of Oklahoma City was the contractor and the bid price was $717,053 for the storm drain work. Charles T. Riney supervised this portion of the work.

The sanitary sewers were designed to provide relief for overloaded sections of the existing system and to furnish sewerage service to some areas not previously sewered. Total construction amounted to about 13 miles of lines. Those sections requiring 30-inch and 33-inch pipe were built of reinforced concrete; all other sections were of vitrified clay except for four creek crossings which were of Armco asbestos coated, paved invert pipe supported on and anchored to steel piers placed on 17-ft. centers. Armco tunnel liner plates were used in passing under the railroad. The new construction permitted abandonment of two sewage lift stations. Clay pipe was furnished by W. S. Dickey Clay Mfg. Co.; concrete pipe by Thomas Concrete Pipe Co.; and steel pipe by Armco Drainage & Metal Products, Inc. The Asplund Construction Co. was general contractor and the cost of the project was $622,552.



● **AIR VIEW of Enid's new sewage treatment plant. Settling and aeration tanks at right; sludge handling facilities at left. Operating building foreground.**

Sewage Treatment

The treatment plant is wholly new and consists of a screen chamber; pumping station; preaeration, primary, aeration and final settling tanks; sludge digesters; sludge drying beds; and a high-pressure gas storage sphere. The units are so designed and located that plant capacity can be doubled at a minimum cost. There is also an office and laboratory building.

● **CONCRETE outfall sewer laid under typical soil conditions.**

● **STORM sewers involved 40,000 ft. of line. This one is 72-inch.**

● **AERIAL sewer — creek crossings were made in this manner.**

SEWER EXTENSIONS PROGRESS

Screening—At the screen chamber there are provisions for removal of coarse and fine screenings and for measurement of the sewage flow. The coarse and alternate screens are hand raked; the mechanically cleaned screen can be operated manually, by time clock or automatically when the sewage reaches a predetermined level. Screenings are discharged to cans. A Parshall flume with an indicator-recorder-totalizer registers the flow in the Control Building.

Pumping—The screened sewage flows to a well in which are located three 3-mgd raw sewage pumps which lift the sewage to the primary settling tanks, from which flow is by gravity to other plant units. The pumps are driven by LeRoi gas engines which use a blend of natural gas and digester gas. The pumps are manipulated by Warrick controls operating from the sewage level in the wet well. The engines are equipped with heat exchangers. Electrically driven pumps are provided for dewatering the sump below the wet well into which the wet well can be drained for cleaning.

Treatment Units — Preaeration tanks are provided for the dual purpose of flocculating the sewage before sedimentation and for grit and grease removal. The detention period in these tanks is 70 minutes. Sluice gates are so located as to permit bypassing of both the preaeration and the primary tanks. The primary settling tanks are rectangular in shape and provide two hours detention at average flow. Weirs are multiple and adjustable. The flow from the primary tanks passes to a channel between the primary and aeration tanks and thence through venturi meters which control the air applied to the aeration tanks.

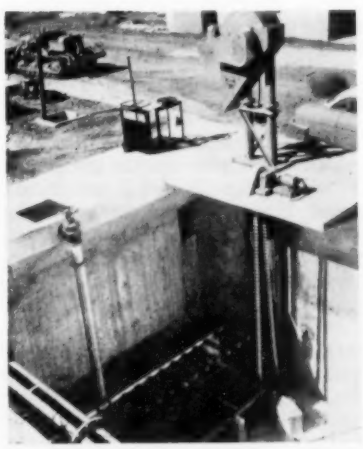
The data in this article are from Bernal H. Swab, Consulting Engineer, Oklahoma City, Okla.

There are two aeration units, each having eight diffuser headers with 36 diffuser assemblies utilizing porous tubes. The step-aeration method is used with sludge from the final settling tanks being introduced at the quarter-points in the tanks.

Digesters—There are two digesters, equipped with PFT floating covers, providing a digestion period of 30 days and a storage period of 70 days. The additional storage is required because the sludge drying beds are not expected to operate efficiently in the winter. Digestion tanks are insulated with brick veneer to reduce heat losses. PFT sludge heating and safety equipment is used. Digester gas is scrubbed and the excess gas, above temporary needs, is stored in a sphere at 50 psi. Gas is used in the gas engines for pumping, for operating the blowers and for driving the emergency generator.

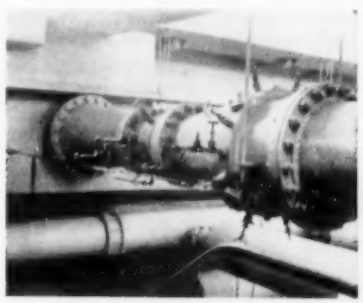
Meters—The plant is well metered. The incoming flow is measured with a Parshall flume supplied with Builders equipment. The primary settled sewage is measured by two 24 by 12-inch venturi meters; the return sludge by venturi meters; the air by orifice meters; and the raw sludge by a venturi. Digester sludge passing to the sludge beds is measured through a venturi tube. All the receivers for these various meters are located on the meter control panel in the Gallery Control Building.

Piping and Valves—All sewage, sludge and sludge gas lines are of cast iron; other service lines are steel and wrought iron. The cast iron pipes were designed and delivered in special lengths and to exact dimensions. Gas and sludge lines are valved with lubricated plug type valves, and all other lines with gate valves. All water lines are insulated to prevent condensation and heating pipes are insulated to prevent heat losses and condensation. A color scheme was adopted to permit easy identification, as follows: Air pipes, aluminum; potable water, blue for



● **PREAERATION** tanks provided grit removal and flocculation.

● **FLOATING** covers were provided for the sludge digesters.



● **SETTLED** sewage meter—one of the many useful facilities.

cold water lines and blue with a 2-inch orange band at 5-ft. intervals for hot water; plant water, orange; sludge heating lines, orange with 2-inch black bands at 5-ft. intervals; sewage gas, red; natural gas, red with 2-inch black bands; sewage lines, gray; primary sludge lines, brown; sludge return, brown with 2-inch white bands; waste sludge, brown with yellow bands; digested sludge, brown, with orange bands; supernatant, green; and drain lines, black.

Sewage Pump Controls—Starting and stopping of the sewage pumps are controlled by the water level in the wet well by means of Warrick controls. If the water level continues to rise, additional pumps are started; and if the level falls, unneeded pumps are cut out. An alternator on the Warrick control panel permits manual change of the pump sequence to provide equal operation for all of the pumps.

Water Supply—Potable water for the plant is obtained from a well 61 ft. deep on the site. A deep well pump discharges into a 220-gallon pressure tank and supplies water to all buildings. Thermostatically controlled strip heaters prevent freezing in the pump house. Plant water is derived from the plant effluent, and is used for flushing tanks and lines and for sprinkling the lawn. The system includes two 125-gpm pumps, an air compressor, a 1260-gal. pressure tank operating to 60 psi, and the necessary lines and controls.

Engines and Blowers—LeRoi gas engines drive three Roots blowers, three raw sewage pumps and the emergency generator. The engines are operated by a blend of sewage and natural gas. The engines operating the pumps and blowers are started by 208-volt AC motor starters. These six engines can be started on either city or emergency power. During a power failure the gas engine directly connected to the emergency generator is automatically started by a battery-operated starting motor; the engines driving the pumps and blowers are then manually started; and this operation must be repeated when city power is again available. Air is furnished by three Roots 2500-cfm positive displacement blowers with horizontal inlet and outlet connections. Pulsation suppression and measuring equipment for the air was furnished by Burgess-Manning and Builders-Providence. There are fixed dry air filters and an electronic filter.

Effluent Use—Water from Bogey Creek, into which the old plant discharged, was used by the Champlin Refining Co. for cooling water. When the old plant was abandoned, there was insufficient flow in the stream. The Champlin Refining Co. therefore constructed a new industrial water pumping station and a pressure line from the new plant to the refinery, presenting the pumping station to the city. Payment is made for the plant effluent used.

Acknowledgements—The Architect-Engineers were Hudgins-Thompson-Ball & Associates of Oklahoma City and Taft & Williamson of Enid. Bernal H. Swab, as engineering associate, supervised the design and construction of the sanitary sewers and the sewage treatment plant, which will be under the supervision of Lance C. DeCory, sanitary engineer of the city of Enid. The project cost approximately $915,000. H. E. Cummins & Sons Constr. Co. was the general contractor. Major equipment suppliers were: The piping and special fittings, Alabama Pipe Co. Lubricated plug valves, the American Car & Foundry Co. Bar screen, tank mechanisms, aeration equipment and pumps, the American Well Works. Stop gates, Armco Drainage & Metal Products, Inc. Sewage and sludge meters and accessories, Builders-Providence, Inc. Heat exchangers, Burgess-Manning Co. Electrode controls for raw sewage pumps, Charles F. Warrick Co. Emergency generator, Electric Machinery Mfg. Co. Gas engines, the LeRoi Co. Digester covers and equipment, the Pacific Flush Tank Co. Blowers, the Roots-Connersville Blower Co. Alternating current engine starters, Techno Electric Mfg. Co. Control centers, the Westinghouse Electric Corp. Meter panel boards, Gustaveson, Inc.

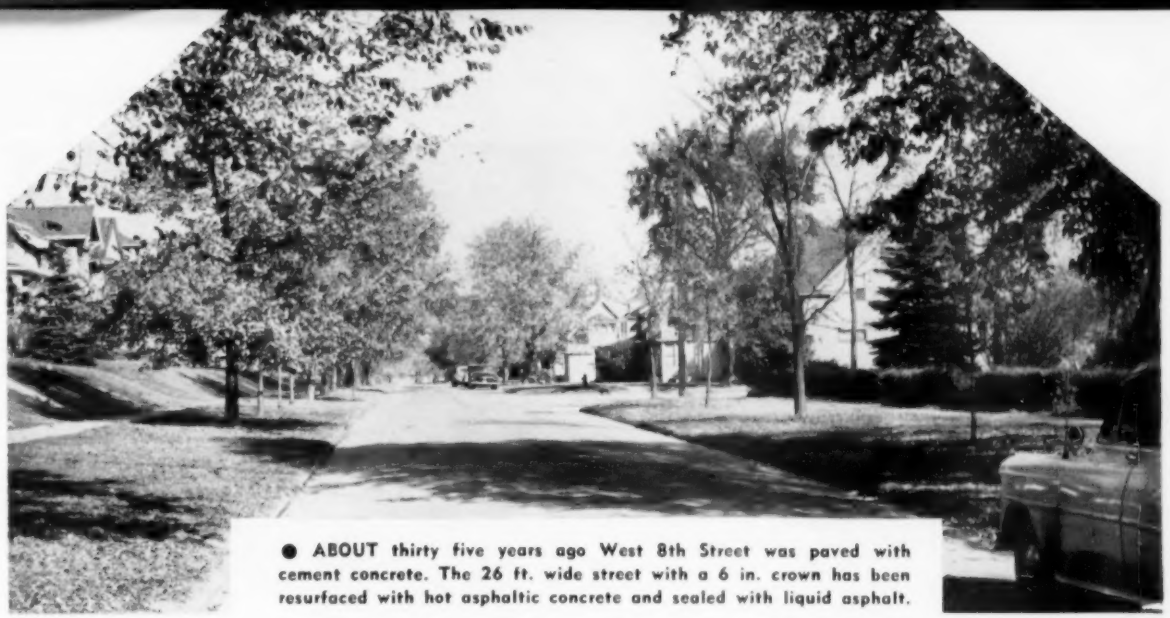
● **FINAL settling tanks are of the rectangular type and are equipped with multiple and adjustable weirs. Primary tanks also are rectangular.**

Roadside Tree Maintenance in Rhode Island

In the program to combat the Dutch elm disease, some 4300 trees along state highways in Rhode Island were sprayed with DDT emulsified solution. The application was mostly made by spotlight during the nights or in the early morning when wind velocity was at a minimum. Two State-owned mist sprayers were used for this work which was done during April.

In the annual tree-spraying program for the control of elm beetles and canker worms, 8262 elms were sprayed last year during the period between May 29 and June 20. As usual, this work was performed by contract under State supervision, the Contractor using the State's two hydraulic spray rigs.

About 400 trees were taken down during the year, 100 of which were infected with the elm disease. In addition, hundreds of trees were trimmed to remove dead limbs, hangers and branches dangerous to traffic. A large part of this work was performed under 18 tree-topping contracts.



● ABOUT thirty five years ago West 8th Street was paved with cement concrete. The 26 ft. wide street with a 6 in. crown has been resurfaced with hot asphaltic concrete and sealed with liquid asphalt.

EXPERIENCE with HIGH CROWN STREETS

in Large Scale Resurfacing Program

ARTHUR W. TEWS, P. E.,
City Engineer
Duluth, Minn.

RESURFACING and seal coating roads and streets has become a great American institution. We are spending more money for resurfacing every year than is spent for any other type of road construction. The country has hundreds of thousands of miles of old worn-out surfaced roads and streets which are in great need of a new surface.

We in Minnesota in general and in my city in particular have been working on a resurfacing program on a large scale since 1944. Many millions of dollars have been spent in these past ten years. Hundreds of miles of old roads and streets have been covered with new surfaces.

Minnesota started with a program using cement concrete for base widening and asphaltic concrete for resurfacing the full width. In 1927 the Minnetonka Boulevard from Minneapolis to Wayzata was widened to 27 feet and then surfaced with asphaltic concrete from curb to curb. In 1928 the Forest Lake cutoff out of Minneapolis was also widened to 27 feet with concrete base and then surfaced with asphaltic concrete. I worked on both of these projects for the Minnesota Highway Department. The Wayzata Boulevard was again resurfaced several years ago; but the Forest Lake road is still carrying traffic over the asphaltic concrete surface which is now 25 years old.

Our resurfacing program in Duluth started in 1945, and has grown every year since that time. This year we are resurfacing about 10 miles of arterial streets costing almost one million dollars. We have approximately 750 miles of streets, classified as follows: 150 miles of concrete, 70 miles of asphalt, 250 miles of oiled, and 280 miles of unimproved.

On account of the steepness of the hillsides running from the level of Lake Superior to a maximum elevation of 500 feet, producing grades up to 27%, plus the wide temperature range, running from 47° below zero to 106.75° above zero, we use only the highest type of asphaltic concrete, made from 100 percent crushed coarse aggregate, ⅝-in. maximum size, fine sand, mineral filler and asphaltic cement.

We started using a fairly low penetration asphalt, 70-85, and gradually increased the softness until we got up to 120-150 which seems to give us the best results. Resurfacing the steeper grades on the avenues which run at right angle to the shoreline of Lake Superior and have grades from 7 to 11 percent, we keep the asphalt content down as low as possible—4.5 percent minimum and 5.5 percent maximum. On ordinary grades we use about 6 percent asphalt.

All of our downtown avenues have grades near the 11 percent mark. The pavements were built about 1900, with a 5-in. concrete base, a sand cushion and granite cobblestone. We resurfaced these avenues under one contract in 1947, including 37 blocks on eight avenues. Because of the lateness of the season, no seal coat was placed until the following year. During the winter considerable abrasion took place from the constant grinding of the car and truck chains, and the use of sand and salt for ice removal. We placed a heavy seal coat on all this work in late April the following year, using approximately 0.25 to 0.30 gallon of RC-3 cutback and about 35 pounds of washed sand. This heavy seal coat lasted for several years, giving us good service. We resealed in 1952 with RC Special No. 2 and washed sand, using about the same amount of oil and sand as in 1948.

Our standard practice is to seal-

● **WIDENING a 16-ft. concrete pavement to 36 ft. with concrete base, curb and gutter and asphaltic concrete resurfacing.**

coat all mats shortly after they have been placed. We now use RCS on all our high type mats because we find it very satisfactory. It cures rapidly and has about the right amount of asphalt cement to give stability and endurance.

Traffic on our steep streets, during the winter months, where abrasives, salt and chloride are used for de-icing purposes, develops a scrubbing action which affects any and all types of pavement. We have many streets which require a seal coat every year.

We have surfaced every type of pavement in existence in Duluth today. Brick has given us the most trouble because of its hard, smooth, impervious surface. We found that on brick streets we had to increase our thickness by one leveling course, 1 to 1½ ins. By placing an increased thickness over brick we produce a mat which has sufficient strength and stability to withstand traffic. On our better concrete streets we clean the joints and cracks with the Tennant equipment and fill the cracks with rubberized asphalt to seal off all sub-surface water. We find this work expensive but it is worth what it costs.

We still have some street car rails to cover, in spite of the extensive salvage program during World War II. To overcome the weakness which generally can be expected over the tracks, we place an additional leveling course. We do this by dragging the screed on the Barber-Greene machine. This gives us a thin sub-leveling course which we roll thoroughly before placing the regular leveling course.

We have developed a high crown formula in Duluth which gives us a 6-in. minimum crown on narrow streets, and up to 15 ins. on our wider streets. This high crown formula has produced surfaces which dry almost instantly after the snow has been plowed or the salt and sand has been applied for de-icing purposes.

The traffic moving over these high crown surfaces produces a slight side draft which forces the loose material toward the gutters, leaving the center portion clean and dry. In our design we try to increase our crown by placing a maximum thickness in the center of the street, and a minimum at the gutter line. We generally place a sub-leveling course, or even two, to build up the crown. We place a maximum of 1 inch along the gutter line. We tack the gutters 2 feet wide with about 0.05 gallon per sq. yd., and we fog the remainder of the surface with a hand spray held several feet above the pavement surface. We also use the RCS for tacking purposes because it sets very rapidly and does not discolor vehicles which must run on the surfaces.

The 40 days of freezing and thawing in the spring and the 10 to 30 days in the fall produce maximum wear on all our street surfaces where the driving lanes remain constantly wet. With the high crown our driving lanes are dry 90 percent of the time during these two frost periods.

● **ORIGINALLY 26-ft. oiled surface over crushed rock base with 10 percent grade. Widened to 40 ft. and resurfaced.**

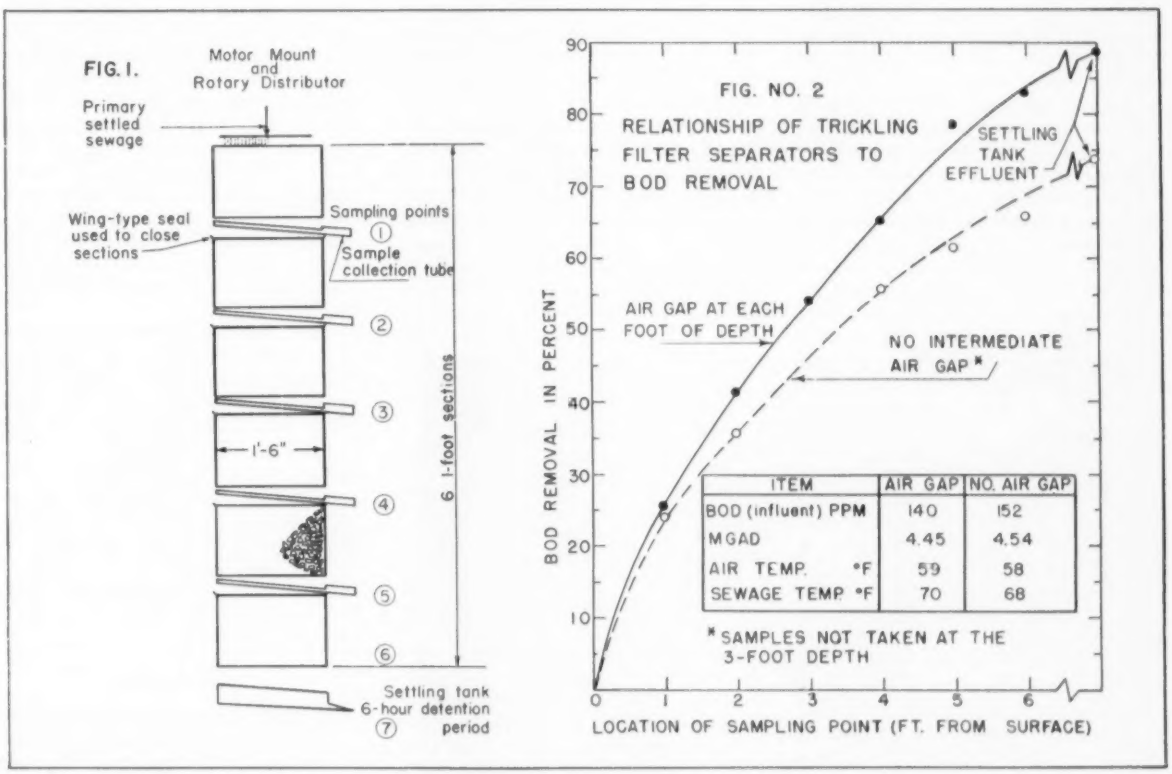
● **ANOTHER view of completed 8th Street job. Note the car perpendicular to center line which indicates high crown.**

Vertical Separators aid in EXPERIMENTAL TRICKLING FILTER

E. F. GLOYNA,
Associate Professor of Civil Engineering,
The University of Texas
MANSEL SMITH,
Plant Superintendent, Austin,
Sewage Treatment Plant

INCREASED trickling filter efficiencies through the use of either well designed natural or forced ventilation systems have been discussed at considerable length; however, the advantages gained by shallow separated filters have not been reported as frequently. In reality, the question of ventilation embodies two considerations: does the addition of a forced or special ventilation system enhance the oxidation of decomposable organic matter; and, if so, is the advantage gained economical? From the data reported herein, the separated filter demonstrated advantages over a well aerated filter in BOD removal.

There are many statements in the literature to support the need for forced ventilation. Imhoff (1) found that properly designed false bottoms in small installations provide adequate ventilation, but larger units require under drains connected to chimney vents. Data collected over a 3-year period by Dekema, et al, (2, 3) showed that an enclosed aerated filter could treat two times the volume of sewage per cu. yd. of filter medium to the same degree of purity as an open naturally ventilated filter. Shock loads were more easily handled and less odor was observed in enclosed ventilated-filters than in open filters. Investigations by Pönniger (4) demonstrated that natural aeration was insufficient for supplying oxygen to a filter treating a concentrated sewage. Phelps (5) favored building filters above ground with as much ventilation as could be obtained through the side walls; however, where construction was below grade, he also recommended special provisions for ventilation. A trickling filter was constructed above ground at Rayne, Louisiana, which



● **EXPERIMENTAL trickling filter in expanded position is shown at left. Chart at right shows effect of air gaps on BOD removal.**

had perforated brick side-walls, and beneficial results were reported. (6) The present trend in Poland is toward closed, artificially ventilated trickling filters; however, this may be due to severe winter conditions in that country. (7) Some investigators recommend forced draft during certain seasons of the year. Halverson, Savage and Piret (8) found that if the temperature of the liquid in the filter was higher than that of the air, an updraft existed; and if the air was warmer than the liquid, a downdraft occurred. When there was a slight or no temperature difference, the air flow was small and depended mainly upon the difference between the humidity of the air inside and outside the filter. Consequently, forced ventilation has been beneficial during seasons when the air and liquid temperature are the same. Johnson (9) substantiated the effect of temperature on drafts, and estimated that a temperature difference between sewage and outside air of 5° F. will assure adequate treatment by supplying 0.1 cu. ft. of air per minute per square foot of filter area.

Forced ventilation has not been recommended by another group of investigators. For example, Buswell and Elder (10) found upon analysis of the air moving through a trickling filter that there was an insignificant depletion of oxygen, the maximum depletion being 0.4 percent. Babbitt (11) relates that satisfactory operations have been observed for some plants that have filters with submerged underdrains. Forced ventilation through revolving cowls or suction fans connected by pipes to the underdrains and ventilation through open side walls has not been practical in other places. (12, 13, 14). Three opinions on trickling filter ventilation are frequently expressed: 1. All needed ventilation comes from the top of the filter. 2. Additional side ventilation is desirable. 3. Adequate bottom drainage is necessary.

An investigation was undertaken to study the value of a sectional-type trickling filter as compared to a single filter having a continuous wall from top to bottom. The trickling filter, prior to its use in the investigation reported herein, was used to study the treatability of an industrial waste at very shallow depths.(15) Consequently, is was not specially designed to study ventilation; however, it was adaptable.

Experimental Procedure

The experimental unit, Fig. 1, consisted of an 18-inch diameter metal shell, a rotating distributor and pumping equipment. The shell consisted of six separate one-foot sections which were removable and were equipped with bottoms made of reinforcing steel. A 2-in. x 2-in. wire mesh supported the one-foot depth of rock. These one-foot sections could either be raised to obtain a 2-in. separation between sections, or the one-foot filters could be set together to provide a single 6-ft. deep filter. Putty was placed around the joints to prevent air leakage through the walls when the sections were united. A one-inch diameter, sample-collection pipe was placed at each one-foot depth. The collection pipe in the filter was open at the top, but the section protruding from the filter was closed and kept tightly stoppered. The filter medium was crushed limestone—100 percent passed a 4-inch screen, and 95 percent was retained on a 2-inch screen.

The waste supplied to the trickling filter was settled domestic sewage. As a result of the air entrainment during pumping and distributing, the sewage was well aerated. The average temperature, hydraulic loading and organic loading were fairly constant.

Composite samples were obtained by collecting samples every two hours from selected points. Prior to actual collection the rubber stoppers were removed from the collection pipes and the trapped or aged wastes were allowed to run out. All samples were stored in a refrigerator during the 24-hour collection period. After the last sample was collected, BOD, NH_3, NO_2 and NO_3 tests were made.

Results and Discussion

The BOD removal by the separated filters was greater than that obtained by the single filter. As shown in Fig. 2, the BOD removal by the sectional type and continuous-wall filters, including settling, was about 90 and 75 percent, respectively. Variable factors such as temperature, organic loading and hydraulic loading were approximately equal in both experiments. The average influent BODs were 140 and 152 ppm for the separated and conventional filters, respectively. Similarly, the separated filters were dosed at a rate equal to 4.45 mgad while the single filter received 4.54 mgad.

The separated filters produced an effluent which contained slightly more nitrites and nitrates than the effluent from the single filter.

The conventional-type trickling filter was well aerated. Ventilation through the continuous-wall trickling filter was observed by holding a flame near an open sample collection-pipe. Considerable draft was always observed at all points, although the direction of air flow was not always the same. The change in the direction of self-ventilation was apparently due to differences in air and sewage temperatures.

While it might appear that the two trickling filter systems used in these tests were essentially the same, the BOD removal was markedly different. The degree of treatment is generally dependent upon the following factors: (1) amount of organic load treated per unit of time; (2) relative abundance of biologically active growth; (3) adequacy of air-liquid interface; (4) time of contact between organic material and biological growth; (5) degree of agitation and turbulence at the interface of slime and liquid substrate; and (6) adequacy of settling. As far as these brief tests show, all of the above factors were similar in the two experiments except possibly (3) and (5). The difference in BOD removal was probably not primarily due to factor (3), adequacy of air liquid interface, because the single filter never ponded, and there appeared to be free movement of air at all times. Therefore, the difference in BOD removal was most likely a result of the added agitation obtained by filter separation and repeated turbulence at the interface of growth and liquid waste.

The practicality of separated filters is problematical until an adequate and easily maintained type of separator is devised. A separated filter might be developed, however, for the economical treatment of a "difficult-to-treat" industrial waste. The preliminary data described herein suggest that where a great number of recirculations are necessary it may be well to reduce the depth of the commonly used trickling filters and to design trickling filters with special separators.

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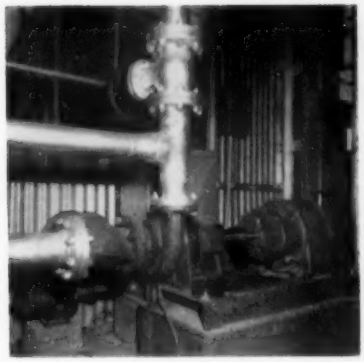
(*Please turn to page* 158)

Meeting a MUNICIPAL POWER PROBLEM



HEADLONG growth entailed serious problems for Farmington, N.M., in the provision of electric light and power for both domestic and commercial use. At the dissolution of the North Continent Utilities Co. in 1945, the Town of Farmington had acquired the distribution system for an area with a radius of 11 miles from the center of town and generating facilities consisting of a 200-kw. hydro plant and a gas engine plant with two 300-hp. and one 250-hp. units. These modest facilities supplied not only the city's 11-mile circle but all of the San Juan County through the lines of the Basin Light & Power Company.

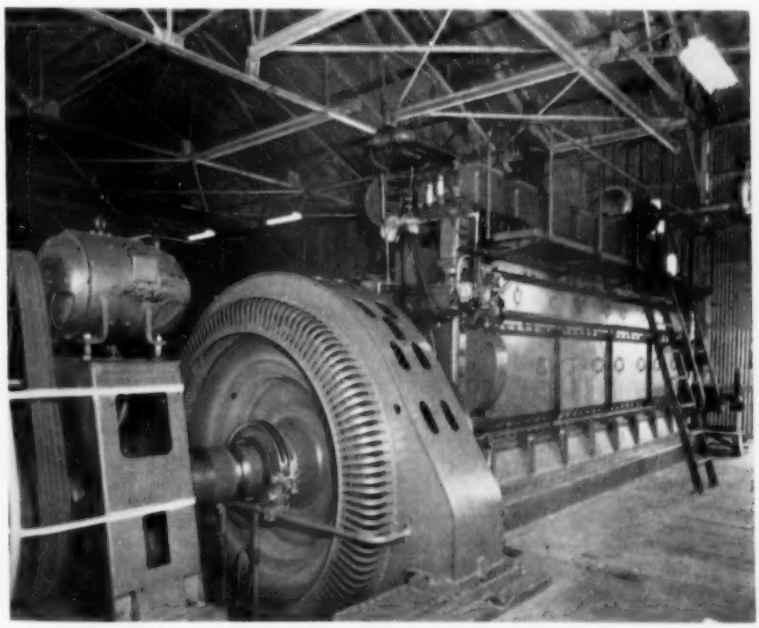
Additional prime movers were added in 1946 and 47: two 250-hp. Bruce-MacBeths and two 370-hp. Ingersoll-Rands. By 1949, the boom was under way and the city quickly constructed a new power house and installed two 250-hp. Bruce-MacBeths and a 932-hp. Ingersoll-Rand. Incredulously, officials watched town and power load grow and recognized that they would have to progress to larger generating units.

The next engine chosen was a Worthington natural gas unit rated at 1,525 hp. at the plant's 5,280-ft. elevation. After an initial period of break-in and adjustment, this engine was put into virtually continuous operation in October, 1952. In the next six months, the engine ran 24 hours a day 7 days a week except for a total of 15 hours for inspection and preventive maintenance. In that six-month period, this engine produced 3,659,700 kw. hrs., more than 53 percent of the total 6,793,781 kw. hrs. generated by the whole system with its eleven engines and hydro plant.

To carry the peaks, all eleven engines must be run at full load, but in off-peak hours, the Worthington handles a disproportionate share of the work. Reason for this preferential use is apparent in fuel consumption statistics. The old plant

averages about 20 cu. ft. of natural gas for each kw. hr. generated. At the new plant, with the big engine carrying three-fourths of the output, average plant fuel consumption has gone as low as 12.05 cu. ft. per kw. hr.; and the consumption for this engine as low as 10.0 cu. ft.

The engine which is achieving this efficiency is one of the first of its kind, a supercharged, high-compression, spark-ignition natural gas engine. It has a compression ratio of 12 to 1, equal to that of a diesel and attains the efficiency of the diesel. There are, of course, a number of important differences. Gas requires a higher temperature than oil to initiate combustion and spark ignition is utilized rather than heat of compression. No pilot oil is required as in the case of the dual-fuel diesel. In the average low-compression gas unit operating on the Otto cycle, the price for eliminating oil is higher gas consumption and lower thermal efficiency, but the high-compression engine cuts gas consumption sharply and still avoids use of relatively high priced oil. At Farmington, where the gas supply is certain and abundant and the price is a low 16 cents per MCF, the consumption of 10 cu. ft. per kw. hr. means a total fuel cost of 1.6 mills per kw. hr.



● **WORTHINGTON 1,525 hp high-compression natural gas engine and Electric Machinery generator and Woodward governor. Cooling pump shown in view above.**

MODERN WATER SUPPLY and TREATMENT

For a Small City

JAMES W. BOWMAN, Design Engineer

J. Stephen Watkins, Consulting Engineers, Lexington, Kentucky

WITH a population of 5,500, Campbellsville, Ky., has had a rapid increase in the demand for water. The occurrence of several dry seasons, and the possibility of attracting more industries combined to focus attention on this problem. The firm of J. Stephen Watkins, Consulting Engineers of Lexington, Kentucky, was engaged some years back to make preliminary studies and to prepare a report for water works improvements.

The studies led to the development of an economically feasible program which called for the construction of a new reservoir, a new treatment plant, additional elevated storage, and certain necessary improvements in the distribution system. The report was accepted and the Engineers were authorized to proceed with the preparation of plans and specifications.

As a basis for the design of the required facilities, a 30-year period was used. It was estimated that the population would then be 7500, with a total domestic, commercial, and industrial consumption of 750,000 gallons per day.

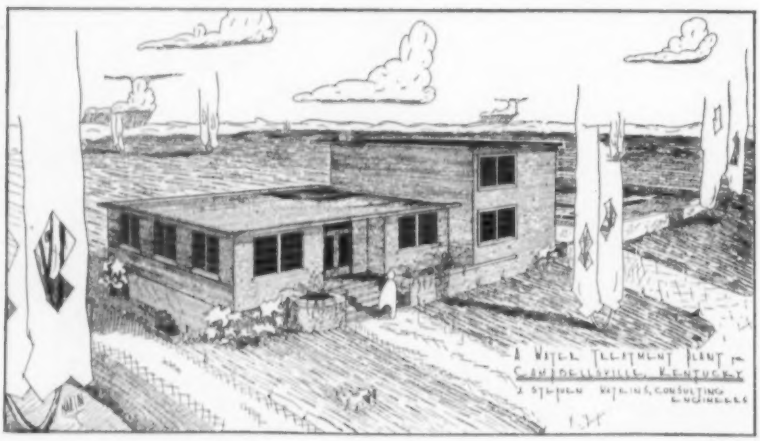
To supply this demand through a protracted drought and also to allow for evaporation, a capacity for a new reservoir of about 300 million gallons was decided upon. Little Pitman Creek, on which two earlier reservoirs had been built was selected as being the most suitable source of supply. A site was picked about one-half mile downstream from the last previous dam with a watershed of 8.4 square miles, and an earth fill dam and appurtenances were designed for this site.

Since the silting problem had been of major importance in the past, special studies were made of silting in connection with the new reservoir. These studies indicated that the two old reservoirs, as upstream desilting basins, would substantially reduce the deposition of silt in the new reservoir for many years, and the practice of proper conservation measures on the watershed might prolong the useful life indefinitely.

The new water treatment plant was designed for a capacity of one million gallons per day with provision for immediate expansion to 1.33 mgd and ultimate expansion to 2.00 mgd. The capacity of 1 mgd is sufficient to care for present demand in 8 hours of operation and for predicted demand in 12 hours. The quick-mix basin was designed for a detention period of 2 minutes at a rate of 2 mgd during mixing of chemicals. The twin flocculation and sedimentation basins have detention periods of 45 minutes and 2.5 hours respectively at a flow of 0.67 mgd through each basin.

Theoretical fire flows were found to be in excess of the practical requirements for the immediate future. However, the design provided facilities adequate to justify more favorable fire insurance rates and insure reasonable fire protection.

Bids were taken on four separate contracts. Contract #I for the ele-



● **ARCHITECTURAL rendering of new water treatment plant having a capacity of one million gallons per day with provisions for ultimate expansion to two million.**

● **RESERVOIR showing new dam with Highway 68 on top in center of picture. New spillway is in right foreground and the treatment plant in left foreground.**

vated tank was awarded to the Chicago Bridge and Iron Company, and Contract #II for distribution system improvements to E. N. Murray, Buena Vista, Georgia. Contract #III for the treatment plant facilities went to Frye Engineering Company, Cynthiana, Kentucky; and Contract #IV for the earth dam and appurtenances to Codell Construction Company, Winchester, Kentucky. Work on these contracts was begun in the fall of 1951. Final completion was in August, 1953.

The dam for the raw water supply has a crest length of 1,000 feet, a crest width of 38 feet, and a maximum height of 45 feet. It contains 116,000 cubic yards of rolled earth fill and 7200 cubic yards of puddled clay core wall, all on a foundation of solid rock. The upstream slope is 3 to 1 and the downstream 2 to 1. Riprap protection is provided on the top 11 feet of the upstream face of the dam. Excess water discharged over a 150-foot gravity ogee weir of concrete flows into a 40-foot-wide channel excavated in the rock around the south abutment of the dam.

U. S. Highway No. 68, which was flooded by the new reservoir, was relocated by carrying it across the dam. Important in the selection of this site was the fact that inasmuch as this relocation constituted a considerable improvement in alinement the Kentucky Department of Highways was willing to share in the cost of the dam and the bridge over the spillway.

● **LOOKING east over new treatment plant toward the dam and reservoir. Flocculation and sedimentation basins are shown adjacent to the filter house.**

Treatment Units

The raw water is fed to the treatment plant by gravity through an intake structure located in the pool 140 feet upstream from the dam. This structure is a concrete tower 7 by 10 feet in section and 50 feet high. A platform on top supports the valve stands for operating intake gates at three different levels and the gate on the blow-off line. The entrance to the supply line to the treatment plant is covered by a screen which may be raised in the guides for cleaning.

There was another complicating feature of the reservoir construction in addition to the necessary highway relocation. The old treatment plant was to be flooded by the new reservoir, hence close coordination of construction was required to assure a continuous water supply.

The treatment plant is located about 300 feet downstream from the dam. Flow is by gravity through the entire plant. The first step in the treatment process is the mechanical mixing of lime, alum and carbon with the raw water by means of an American Well air diffusion unit installed in a quick-mix basin located inside the filter building. Provision has been made for the installation of a raw water pump ahead of the quick-mix should the available head become inadequate.

The flocculation and sedimentation basins, adjacent to the filter building on the north, next receive the flow. These basins are twin concrete structures with a common dividing wall and are sunk in the ground for practically their entire depth. The flocculation chambers are 16.5 feet long by 15 feet wide by 9.25 feet average water depth. The sedimentation chambers are 50 feet long by 15 feet wide with a water depth of 12.5 feet. The bottom of each of the sedimentation chambers is divided into two 25-foot long hoppers 1.5 feet deep with a plug

drain valve in the center for the removal of sludge.

Flocculation is accomplished by means of two American Well horizontal paddle units 6.5 feet in diameter in each flocculation chamber. The individual units are baffled to insure proper distribution of flow from unit to unit and on into the sedimentation basin.

In the sedimentation basin a 75-foot weir skims off the effluent with a minimum of disturbance to the flow and to the settling of suspended material. An overflow weir in the side of each basin serves to regulate the water level in the chambers and to guard against flooding in the filter building.

The treated water is carried through an 18-inch line to the filter gallery for distribution to the filters. Housed in the filter gallery are the rate controllers and filter gage actuating assemblies supplied by Simplex, plus the requisite filter piping. The filter drain lines beneath the gallery floor are 18-inch diameter concrete pipe encased in concrete.

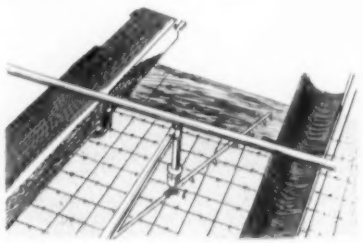
Of the four 10 by 12-foot filters built under the present program only three were equipped for immediate use. These filters have Aloxite porous plate underdrains supporting 30 inches of graded sand. Palmer surface wash systems are provided in all filters. Two concrete wash troughs per filter discharge into a 2-foot wide gullet crossing the front of the filter. The filter valves are manually-operated from floor stands on the operating floor. Rate of flow, loss of head and sand expansion gages of double dial floor-stand mounting by Simplex are provided for each filter.

The filter effluent enters a 12-inch line which goes to the filtered water storage basin 50 feet south of the filter building. This basin is an underground concrete structure 28 feet square by 10 feet deep with a capacity of 52,000 gallons. The water level in the filtered water basin is indicated, totalized, and recorded on a panel in the filter building by a Simplex transmitter and meter.

In the basement of the filter building are three Peerless pumps with space for a fourth unit. A 500-gpm and a 750-gpm high-service pump supply filtered water to the distribution system. A 2400-gpm pump supplies wash water to the filters. All take suction from a common header which is fed from both ends by separate 12-inch lines from the filtered water basin. The pump controls are located in the pump room adjacent to the pumping units.

The high-service pumpage is metered by a Simplex venturi meter on the discharge main at the front of the filter building. Readings are transmitted to an indicating, totalizing and recording meter in the filter building.

Dry chemical feeders are placed adjacent to the quick-mix basin. The pre-lime and alum are fed directly into the quick-mix basin. Post lime is introduced to the filtered water enroute to the filtered water basin and carbon may be fed directly into the quick-mix basin or into the settled water line just ahead of the filters. The feeders are Omega Universal with extension hoppers through the floor of the chemical storage room above. Chemicals are hoisted to the second floor storage room from the loading platform by means of a sling and electrically-driven chain hoist which swings into the building when not in use.



One chlorinator from the old plant and one new Wallace and Tiernan MSV chlorinator were installed in the new filter building. Pre-chlorine is applied directly into the quick-mix basin and post-chlorine is fed into the filtered water as it leaves the filter building on the way to the filtered water basin.

Other features of the filter building are an employees' toilet and locker room and a combined office and laboratory on the operating floor. The master meter, filtered water basin level meter, new elevated tank water level meter, and high-service pressure meter are mounted on the wall of the office where they may be readily seen by the operator.

The filter building itself is of reinforced concrete construction to the operating floor level; the roof over the operating floor, and the chemical storage floor, both concrete slabs, are supported by reinforced concrete framing; the chemical storage roof is a concrete slab supported by reinforced concrete cross beams which frame into a concrete peripheral beam bearing on brick and block masonry walls.

Walls from the operating floor up are of brick with cut stone trim and concrete block back-up which serves as the interior finish. On the operating floor the office and laboratory, filter gallery, and corridor floors are finished with asphalt tile and the locker and toilet floor is quarry tile. All other floors in the building are concrete with plain hardener.

A meter shop and garage in a separate building of matching architecture were designed but were not included in the present construction program.

The additions made to storage facilities for treated water include the filtered water basin at the treatment plant and a 250,000-gallon elevated storage tank erected near the city limits at a point diametrically opposite the old storage tank. This elevated tank is the ellipsoidal type supported on six tubular legs with a riser pipe 48 inches in diameter. The height to the high water level is 68 feet. Cathodic protection was installed by the Harco Corporation using aluminum electrodes.

To control the water level in the old elevated tank a Chapman motor operated gate valve actuated by a pressure switch was installed. At the new elevated tank a Builders-Providence chronoflo transmitter was installed to indicate and record the water level at a receiver in the treatment plant. High and low level alarms are also provided on the receiver to signal the operator when either condition exists at the tank.

Under Contract #II the additions and improvements to the distribution system consisted in the laying of 6900 feet of 6-inch, 9700 feet of 8-inch and 30 feet of 10-inch cast iron bell and spigot pipe, together with 22 fire hydrants and 28 valves ranging in size from 4 inches to 10 inches. These lines were laid where it was necessary to reinforce inadequate mains and to provide a loop to the new elevated tank. Construction of the elevated tank foundations and altitude valve pit were also included in this contract.

E. A. Bailey of J. Stephen Watkins, Consulting Engineers, was resident engineer in charge of supervision of all construction. The construction cost of the total project broken down by contracts follows: Contract I (elevated tank) $31,290; Contract II (distribution system) $81,956; Contract III (treatment plant) $248,335; and Contract IV (dam) $121,938. The total of $483,519 was reduced by cash credit from Kentucky Dept. of Hwys. of $44,025, leaving a net cost to the community of $439,494. A new schedule of water rates and hydrant rentals has been put into effect which enables the project to be financed on a self-liquidating revenue bond basis.

● **PRESENT Court Street bridge after replacing defective concrete and repairing reinforcement steel and covering with new concrete blown in place.**

GUNITE REPAIR for a CONCRETE ARCH BRIDGE

C. LELAND WOOD

City Manager, Watertown, N. Y.

BACK in 1920, the city built a new bridge at the Court Street crossing of the Black River which flows through Watertown. This bridge has a lower deck at the Main Street level and an upper deck which carries Court Street across the river. The river span consists of a 195-ft. reinforced concrete arch span which supports both decks.

Since 1920, no alterations have been made, except removal of trolley tracks, replacing the pavement in the truck area and later resurfacing the brick pavement with asphaltic concrete. Little has been needed in the way of maintenance except replacement of portions of concrete affected by seepage. However, the City Engineer's inspection of the bridge last year resulted in a recommendation that extensive repairs should be made to preserve the structure and make it safe for today's heavy traffic.

A consulting bridge engineer was retained. In collaboration with the original designer, he reviewed the situation, advised immediate posting of the structure against traffic speed and loads and advised starting repairs as soon as possible.

It was estimated that the cost of the work required to place the bridge in good condition, would approximate $150,000. The City Council promptly authorized a bond issue to provide funds for the work and instructed the City Manager to proceed forthwith.

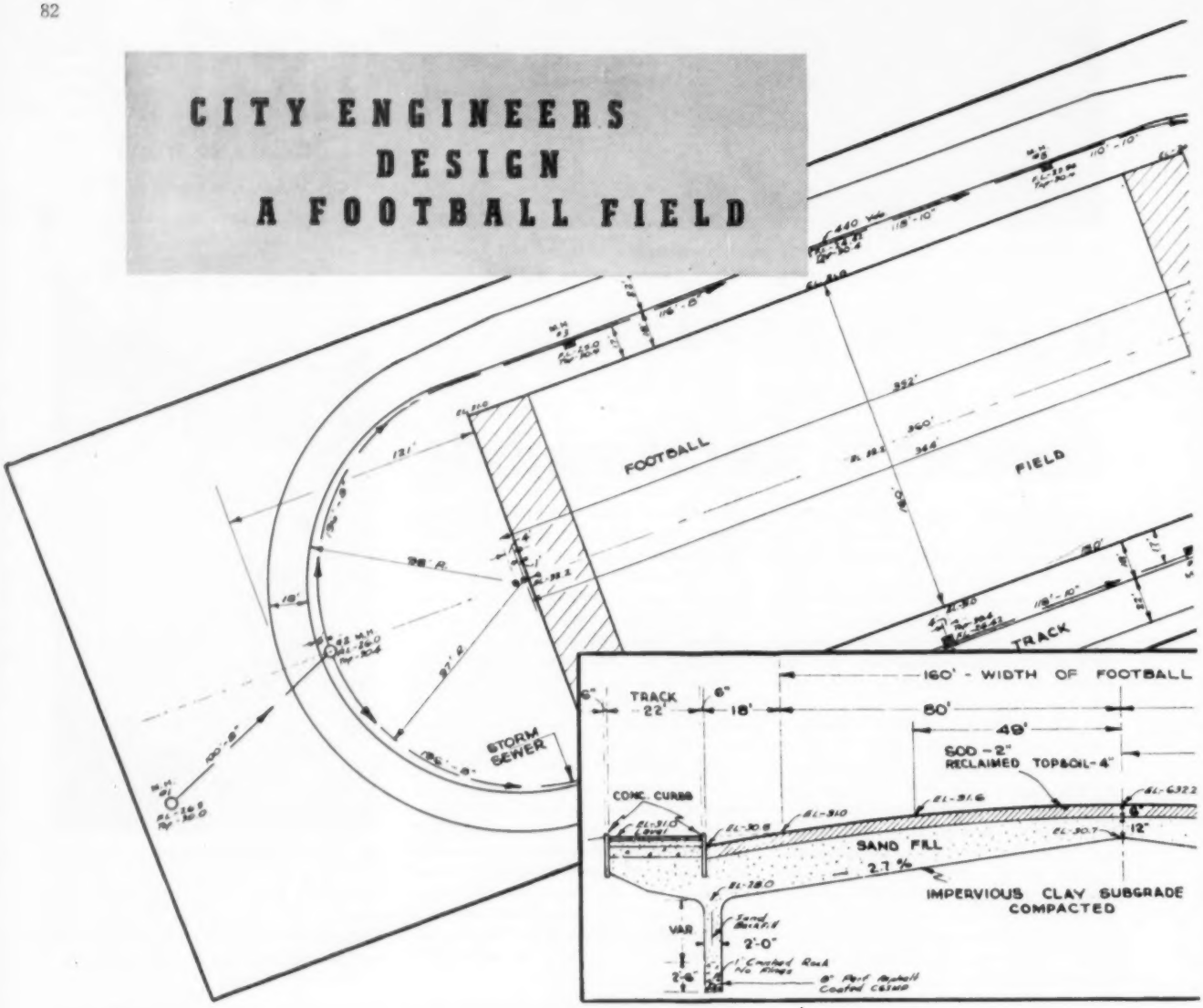
Due to the difficulty in determining the extent of repairs necessary without considerable delay, there was no feasible method of preparing a contract on a unit price basis. Preliminary investigations were not sufficiently complete to decide what work was to be done first, until late summer, when all speed had to be made to beat the cold weather. The corporation counsel advised that a cost-plus form of contract by a municipality was illegal; therefore, to facilitate the repair work, it was decided to undertake the job on a material and time basis.

Equipment and experienced labor necessary to chip off all of the deteriorated concrete and apply pressure concrete was supplied by a private contractor on a per diem basis. A member of the City Engineer's Department was assigned to supervise the work under the general direction of the consulting engineer. Core bearings were made at strategic points to determine the condition of the concrete in the upper slab. Compression tests indicated the samples to be very satisfactory. (*Please turn to page* 88)

● **CHANNEL along parapet where electric cable duct was removed from top of original duct. When excavation was made for new duct, about 18 years ago, workmen cut reinforcement and patched the sidewalk over the severed steel bars.**

● **SOUTH abutment showing area where defective concrete has been chipped off. A layer of new concrete was placed over the sound concrete by pressure method.**

CITY ENGINEERS DESIGN A FOOTBALL FIELD



● **GENERAL layout and cross-section of football field and running track. Field is ridge shaped, level longitudinally, with a reasonable lateral crown.**

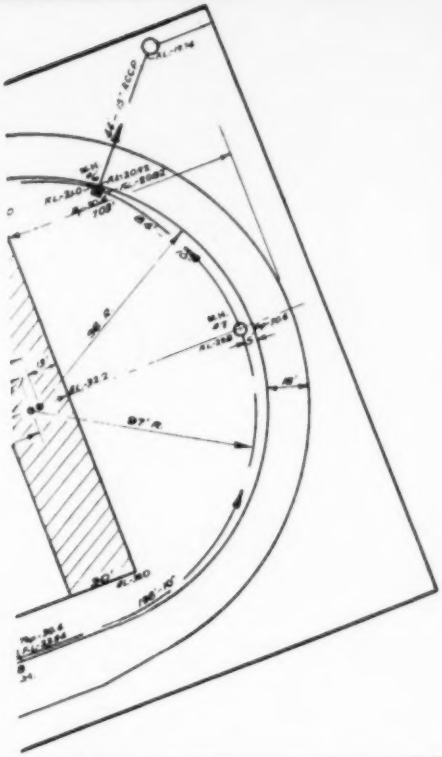
FRED M. SEGUIN

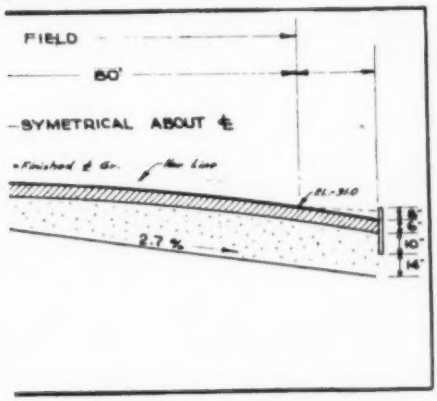
A BRAND new stadium was in order. Superior, Wis. needed a high type football field and grandstand; and of course located to handle the crowds, and with room for expansion. But how to finance this coaches' dream? The officials of Wisconsin State College at Superior under the leadership of President Jim Dan Hill and the Regents, and the city officials under the leadership of City Manager Robert E. Baumberger and the city council thought that it might be possible to get together and make it a joint venture. After a great deal of investigation and red tape (this took a few years) an agreement was finally consummated and in the last week of October, 1953 it was legal and we were told to pull out all the stops and have the stadium ready to use the following fall.

It was to be a 50-50 proposition. The State had $100,000 cash to put into the deal and this was thought to be about enough to satisfy immediate costs of building a grandstand. The city agreed to design and construct the football field, including track, subgrade drainage, and a modern sprinkling system—plus paying the State $5,000 per year until the city's investment equaled that of the State's.

The city had decided to do as much of the work as possible with its own manpower and equipment so as to keep its out-of-pocket dollar cost to a minimum. We had trucks, a grader, a D-7 bulldozer, and a Gradall that could be used to advantage. Our sewer department was to lay the storm sewer and built the manholes. A 25-yd. scraper and pull-cat with operator were hired from a local contractor to do the stripping and grading. A local plumbing firm was hired to put in the water pipe.

During the last weeks of the negotiations, when it looked like a sure thing, the City Engineering Dept. was given the green light to proceed with the engineering design of the playing field area. These were somewhat nervous weeks as we had to get the grading, drainage and sprinkling systems in before the heavy December frost. When the go-ahead for commencement of actual construction was given we had the design far enough along to





move right in and start the stripping and grading. This was on Oct. 27—and not a day too early.

Design Factors

In most engineering design it is quite customary, and convenient, to lean as heavily as possible on standards and precedents. A brief investigation revealed that there wasn't much design information on football fields—except surface layout. Also, as with many of our problems in Northern Wisconsin, we soon recognized the fact that the design of this facility would have to meet the demands of our peculiar conditions.

What we were concerned about most in the investigatory stages were: 1) Subgrade—materials and shape; 2) subgrade drainage; 3) sprinkling system; 4) how to shape the finished surface longitudinally and laterally; 5) what to put the turf on; and 6) how to get good turf quickly.

The accompanying illustrations show our final answers to these problems. However, I believe it will be of some interest to trace some of the thinking behind them.

We had little choice about our subgrade material—this is red clay country. It is as hard as plastic when dry and as greasy as butter when wet—and always impervious. The water must be conducted away. The shape and grade of the subgrade naturally were dependent on considerations 2, 4 and 5.

We queried officials at some of the State Universities and examined some of their plans. We visited a few installations and asked questions.

One of the questions that was of particular interest related to the value of drainage laterals under the football field proper. It was part of the design of one of the fields visited. Because of the nature of the usual installation of these drains we were told that the effectiveness of them could not be easily determined. It was felt that their probable continued effectiveness was questionable. We finally decided that our own impervious subgrade material would act as a dependable drainage table if it were given a positive grade and covered with a suitable granular material—without the use of underdrains.

The shape of the surface of the playing field also came up for considerable discussion — turtle-back, flat, ridge-shaped, how much crown if any? Leo Di Marco, coach at Wisconsin State College, was consulted. Available plans were consulted. Our City Superintendent of athletics, former coach Harry Conley, was consulted. It was the consensus of opinion of all of us that the ridge shape, level longitudinally with a reasonable lateral crown, was the most desirable.

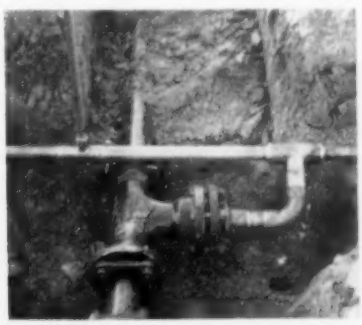
Another question that came up, depending for solution in large part on policy, was the location of the track in relation to the field. Most available standards for this layout showed a 30-ft. dimension between the edge of the football field and the near track curb. At first we went along with this but on second consideration thought there was a possibility of cutting this distance down some in order to bring the spectators in the stand closer to the game. This was talked over at length with coaches and fans and it was finally decided to cut this distance down by 12 ft., making it 18 ft. Thus a strong 16 ft. of unobstructed turf was made available to offside play (the manhole curb-inlet type cover grates projecting little more than a foot from the curbs).

As these considerations were resolved we were in a better position to proceed with the design. The final centerline grade of the field was determined in relation to the surrounding contours and a reasonable balance of dirt yardage—cut and fill. In this case the north end of the field was a fill section near centerline, and the south end all cut.

The compacted red clay subgrade was designed with a full 2.7% grade from centerline to the two sides. It

(*Continued on page* 132)

● **GRADALL used to excavate trenches for drainage and water sprinkler lines.**



● **CROSS-CONNECTION of piping installed for the field sprinkling system.**

● **STOP and waste assembly on east side of field in storm sewer trench.**

● DUMPING refuse on the sanitary fill operated by the municipality.

Complaints Reduced 95% by Municipal Refuse Collection

DAVID A. BINGHAM,

Administrative Assistant,

City Manager's Office, Iowa City, Ia.

MUNICIPAL garbage and trash collection service was initiated in May, 1953, by Iowa City. A Department of Sanitation was set up to operate this collection service and the sanitary land-fill at the old city dump to which the trash and garbage is transported for disposition.

Prior to the introduction of this city-owned collection and disposal service, the collection and disposition of garbage and refuse was performed by a private firm on a contract basis with the city. Under this plan there was no uniformity in the collection periods; unsanitary and unsightly conditions were prevalent since there were no regulations governing the collection process; and complaints to the city administration, relative to the collection and disposition of garbage, numbered over 3000 per year. The garbage and refuse was disposed of in the same manner in an area which was unsanitary; unsightly in appearance; a fire, smoke, and odor nuisance; and infested with rats.

This situation has been corrected. The collection process in the city is sanitary and efficient, and complaints to the city administration have been reduced to an average of 3 or 4 each week. In addition, the disposal operations at the sanitary fill have been modernized with resultant efficiency, sanitation, and riddance of unsightly conditions.

New Trucks and Bodies

The city purchased three new 1953 Dodge 2-ton trucks with 16,000 GVW rating, 158-inch wheel bases and Eaton 2-speed axle rear ends; and one second-hand 1948 Reo. 2-ton truck to be used in emergency periods. Two of these trucks are equipped with 9-yd. Leach Packmaster bodies and two with 9-yd. Heil Colecto-Pak bodies. These Leach and Heil bodies contain packing and hoisting mechanisms which are operated hydraulically with a special power take-off from the truck transmission.

Ten men compose the collection service of the Department of Sanitation: one foreman, who also handles complaints, and nine men on the three Dodge trucks—three men to a truck.

Only the residential areas of the city, totaling approximately 5,400 homes, are currently served by the trash and garbage collection service; the business areas are serviced by private haulers who also use the sanitary fill. The city is divided into eighteen collection sections and each section is covered once each week by one of the Dodge trucks.

Regulations governing the collection service and operations were incorporated in a city ordinance in April, 1953. These regulations stipulate the kind of garbage and trash the city will pick up, how this garbage and trash should be prepared for collection, how brush should be prepared for collection, what kind of container is to be used by the individual homeowner, what shall be placed in this container, and

● TRUCKS with Leach and Heil bodies used by the city in refuse collection.

where the container shall be placed for pickup.

The city will pick up household garbage, tin cans, paper, rags, dust, leaves, and related waste matter. Tree trimmings and branches less than two inches in diameter are also picked up. Brush must be cut into lengths of four feet or less and tied in bundles. Raw garbage must be thoroughly drained of water and carefully wrapped in several thicknesses of paper. Tin cans, glass, and leaves may be put in the garbage container or into other metal containers.

The individual home owner must furnish his own container, and this container must be all metal, with a tight fitting cover, suitable lifting handles, and with a capacity of not more than twenty gallons. When full of refuse the container must not weigh over 100 pounds. It is required that the container be washed frequently for sanitary purposes.

All items of refuse except brush must be placed in the metal container and the container must be placed either to the immediate rear of the house or on the alley line, but not in the alley, of those individuals having an alley to the rear of their property.

Brush and weeds properly cut and tied into bundles must be placed at the alley where an alley exists. Where no alley is present the brush must be placed at the curb in front of the home. The city will not pick up ashes although the individual home owner may haul ashes to the sanitary fill on his own.

Individuals needing more than one collection a week may have private haulers remove their trash. These private haulers may take the trash to the land-fill if the home owner is a resident of the city.

Cardboard boxes and crates must be flattened and placed in the container when possible. If this is not possible then they must be flattened and tied into bundles and placed in the area designated for brush. Such items as wall board, bricks, plaster, lumber, excavated earth, etc., from construction or remodeling will not be picked up by the city, nor will trees that may have been cut down. These may be removed to the sanitary fill by private haulers.

Task Basis of Work

In the collection process, the men work on a task basis and each truck covers one of the 18 sections of the city in approximately 5½ hours. The three men on one truck can cover up to three houses in one stop. The garbage cans are emptied into the hopper of the collection unit. When this hopper is full, the garbage is compressed into the main section of the body. This compaction process permits up to 18 cu. yds. of wrapped garbage to be carried in the 9-yd. body. Further, the all-enclosed, water tight, steel bodies prevent leakage of liquid material and keep refuse out of sight and smell.

After collection rounds are completed, the trucks are driven to the city's land-fill. Operators at the fill, using a Drott Bull-clam tractor, complete the disposal process by burying, compacting, and covering the garbage and refuse.

Over a period of nine months in 1953-54 each truck averaged 41 loads of refuse per month and 4,000 pounds of collected garbage per load. Heaviest month was August with July and September close behind. January, 1954, showed the smallest collection. Refuse averaged 435 lbs. per cu. yd.

The use of the Dodge trucks, and Leach Packmaster and Heil Colecto-Pak bodies, in Iowa City have reduced refuse collection costs, promoted cleanliness and sanitation, eliminated many injury hazards to the collectors, ameliorated unsanitary and unsightly conditions in the collection and disposal of garbage and refuse, and aided in the saving and economical expending of the taxpayer's money.

Under the contract basis for the collection of garbage, the cost of collection service per householder per year was $4.16. Under the present city-owned garbage collection service, the cost per householder per year is $2.53. The amount appropriated for 1954 for the city-owned garbage and refuse collection and disposal service was $49,500; $37,700 for collection and $11,800 for disposal. The cost of collection for garbage and refuse per householder per week is twelve cents; the cost of disposal for garbage and refuse per householder per week is four cents.

It is to be noted that, under the contract method, the contractor never made the prescribed number of collections. We collected only garbage, and his collection periods were irregular contrary to contract stipulations. Under the present city-owned system regular weekly collections are made, garbage and refuse are picked up, adequate records are maintained, and improved sanitary conditions have been effected.

The adoption of this new garbage and trash collection and disposal service is one of the management improvements introduced by City Manager Peter F. Roan.

● **REFUSE consisting of garbage, tin cans, glass and leaves placed in metal containers, twenty gallons capacity or less, collected by city employees.**

PRODUCTION AND USE OF OZONE IN WATER TREATMENT

EDWARD W. LINGEL,
Graduate Student
University of Illinois

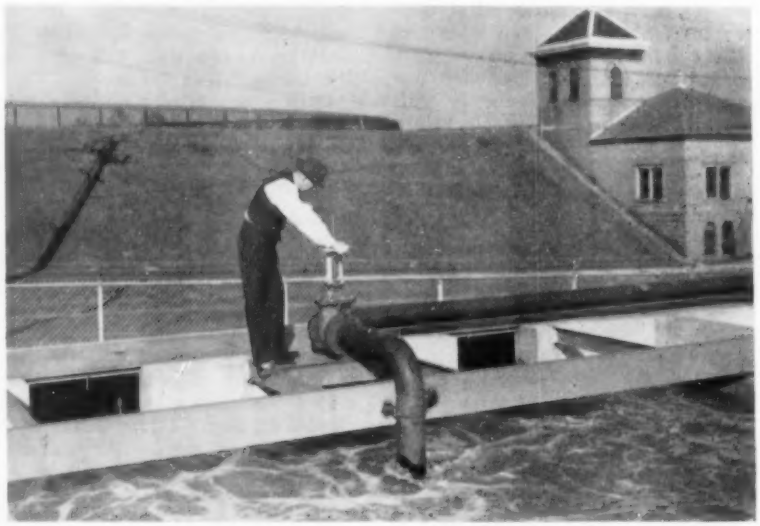
OZONE is a pale-blue gas at temperatures above minus 112 C. Its odor is described as fresh, penetrating, characteristic, and slightly chlorinous. Ozone is an allotropic form of oxygen with three atoms of oxygen per molecule; therefore, it has a molecular weight of 48 and is represented by the chemical formula O_3. The chemical behavior of ozone and oxygen is similar; but ozone is much more chemically active with a greater oxidizing power. The oxidizing power of fluorine, only, is recognized as greater than the oxidizing power of ozone. The formation of ozone is endothermic; the chemical reaction represented by the equation $3\ O_2 + 62{,}820$ cal $\rightleftarrows 2\ O_3$. The reverse reaction, decomposition of ozone into oxygen with evolution of heat, is rapid at normal room temperatures or in the absence of large volumes of diluting oxygen. At 200° C, the decomposition of ozone is instantaneous.[1]

Ozone may be produced[2,3] by evaporation of water, by chemical reactions, by incandescent bodies, radioactive elements, ultra-violet rays, electrolysis, and by the electrostatic field of silent discharge of a high-tension electric current through a stream of air. The last method is most widely used in the production of ozone for water treatment. In this method, air is cleaned, compressed, dried, and subjected to an electrostatic field in an ozone generator.

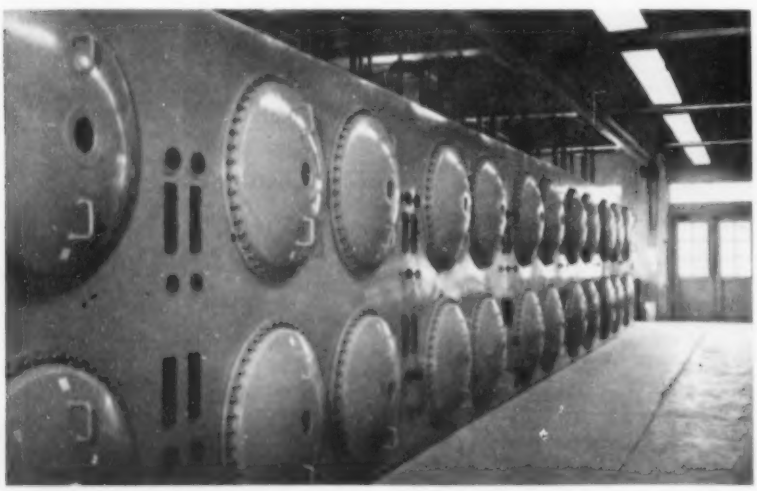
Clean air is essential for efficient operation of the ozone generator, prevention of wear in the compressor, and prevention of clogging of drying media in the desiccator. Dust particles, in passing through the electrostatic field in the ozone generator, are electrified and attracted to the electrodes. The particles, thus deposited on the surface of the electrodes, tend to concentrate the electrode charge into regions of intense electrification and a sparking discharge results, instead of the silent discharge which is necessary for the formation of ozone. Not only is efficiency reduced, but also the electrode may be destroyed by the nitric acid ultimately formed[4] from oxides of nitrogen, produced by the sparking discharge, and the water in the air. Air may be cleaned by passing it through an electronic-precipitation filter.[5]

The clean air is compressed, cooled, and passed through a desiccator containing a drying agent, such as calcium chloride, activated alumina, or silica gel. Compression with subsequent cooling removes the major portion of the moisture in the air. Desiccation completes the drying process. Dry air is essential for maximum production of ozone and protection of generator electrodes

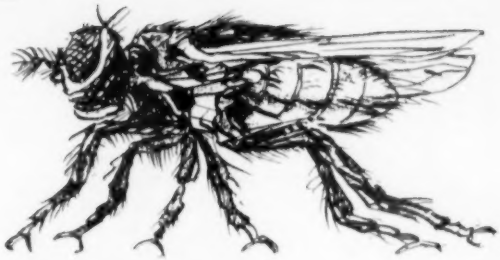
(*Continued on page* 156)



● **OZONE application chamber where Schuylkill River water is being treated with Welsbach ozone at Belmont filtration plant, Philadelphia, Pennsylvania.**



● **BATTERY of Welsbach Type-C ozonators for the production of ozone by subjecting clean, dry, compressed air to an electrostatic field in the apparatus**



FLY Control

AT A SEWAGE TREATMENT PLANT

W. N. WELLS
Supt. Sewage Treatment,
San Antonio, Texas.

THE dubious distinction of maintaining what are probably the most efficient fly incubators in the United States goes to the San Antonio, Texas, sewage treatment plant. These consist of ten open digesters each seventy-five feet in diameter and twenty-six feet deep at the sidewalls. The digesters were completed in 1937 under a Public Works Administration grant and were designed to take floating covers. Due to insufficient funds, the covers were not provided and hence the fly problem.

Sludge from primary clarifiers and excess activated sludge is pumped to the digesters. During digestion, a scum forms at the top of the digesters which is normal and something of a problem at all sewage plants. The problem is accentuated at the San Antonio plant due to the open digesters and lack of any provision for mixing or heating the digester contents. At the surface the scum dries and cracks into hard cakes six to twelve inches in thickness. The surface is very slowly but constantly changing, the lumps turning and working under and fresh material being exposed. This turning is an extremely slow process and it may take months for the surface of a digester to change completely.

The above described condition offers an environment almost ideal for fly breeding. Eggs are laid in the moist cracks between the cakes and the larvae emerge and grow in this region. As pupation approaches, the larvae migrate into the semi-dry region at the surface and there pupate. When the adult fly emerges from the pupa case, he has a surface upon which to rest until his wings dry, and the cycle is complete.

Semi-tropical weather prevails in the San Antonio area and the fly problem exists for about eight months of the year. Working in cooperation with the Texas State Department of Health, several approaches to the problem have been tried: recirculation of the contents of the digester to obtain a surface too wet for the flies to breed; coating the surface of the digester with cut-back asphalt to prevent the adult from laying eggs; and spraying with various insecticides to kill the adult fly.

In order to circulate the contents of the digesters, a fire hose was attached to the discharge side of the supernatant liquor pump and supernatant liquor was pumped from the digester and directed against the scum through a nozzle. About three days were required to get the surface broken up and the operation had to be repeated in about one week. As the supernatant pump had to be used for pumping supernatant liquor from the other digesters part of the time, it soon became apparent that it would be impossible to keep the surface of all ten digesters in a liquid state and also pump supernatant liquor. It is thought that the installation of a permanent recirculation system would have merit.

During the early spring of 1953, it was decided, as an experiment, to try to seal the surface with a coating of asphalt, so 13,250 gallons of cut-back asphalt (RC-2) was applied to the surface of the ten digesters. This experiment was a failure due to the fact that the constantly turning surface soon exposed enough fresh material for fly breeding. Although eight months later there were patches of asphalt remaining, about 90% of it had turned under.

During 1952, several insecticides

● **SPRAYING** equipment used at the San Antonio plant. The truck mounted sprayer has a capacity of 300 gallons.

● **MALATHON** insecticide was sprayed on burlap sacks in a garage for testing. Kill of flies after 92 hours is shown.

were applied. Lindane, benzene hexachloride and methoxychlor were tried. Of these, methoxychlor seemed to be the most effective. It was purchased as a 50 percent wettable powder and 32 pounds were mixed with 100 gallons of water. This mixture was applied with a power sprayer to the surface of the digesters, around the outside walls, to the sludge drying bed area and to the general plant area. During the middle of the summer, 300 gallons of the mixture was applied to the surface of the digesters three times per week. Once each week, 100 gallons were sprayed on the drying beds and the general plant area.

During 1953, spraying was started early in March, at first once per week, and then two and three times per week until the middle of November. Good control of flies was maintained. During two weeks in July and August, Lindane with an extender was tried with little success. In September another highly recommended insecticide, Malathon, was tried. It is claimed by the producers of Malathon, o,o-dimethyl dithiophosophate of diethyl mercaptosuccinate, that it is a stomach poison to which flies will not develop a resistance. Malathon was purchased as an emulsifiable liquid containing 50 percent Malathon, 40 percent petroleum distillate and 10 percent inert ingredients. Two gallons of this liquid were mixed with 100 gallons of water and two gallons of blackstrap molasses. The digester surfaces and walls were sprayed with this mixture with excellent results. A good kill of adult flies was obtained both by contact and by residual action. The residual effect did not seem to be quite as good as that obtained on a test area in a garage. It is believed that the poison was absorbed by the material in the digester and that a better residual effect would have been obtained if the poison had been furnished as a wettable powder. The manufacturers have been contacted regarding this point.

The quantities of various insecticides used during 1953 are shown in Table 1.

Table 1—CHEMICALS USED FOR FLY CONTROL DURING 1953

	Methoxychlor Pounds	Lindane Gallons	Malathon Gallons
January	0	0	0
February	0	0	0
March	150	0	0
April	450	0	0
May	1050	0	0
June	1500	0	0
July	1300	36	0
August	950	15	0
Sept.	300	0	28
October	350	0	12
Nov.	150	0	0
December	0	0	0
Total	6200	51	40

Of course, the permanent solution of this obnoxious problem is the covering of the open digesters. Funds have been requested for this purpose in the current capital improvement program but in the meantime, plant personnel faces another summer of fly spraying activities.

Repairing a Concrete Bridge

(*Continued from page* 81)

A contract was awarded for the installation of temporary shoring to support the upper deck slabs at the expansion joint beams which needed to be rebuilt. Strips of pavement were removed along the curbing and the transverse joints in the concrete deck slab to permit inspection. The original joint material showed signs of weakness and had to be renewed. After the pavement was replaced a surface treatment of asphalt was applied to the roadway and sidewalks to waterproof the upper deck.

While work on the upper part progressed, the unsound concrete in the lower deck section was removed. The exposed areas of concrete and steel reinforcement were cleaned, new reinforcement placed and the concrete mixture blown in place. Most of the weakened supporting members were repaired prior to the time when cold weather necessitated discontinuance of the work.

About one-third of the estimated cost of the project has been accomplished. The balance of the repair job consists of removal of the impaired concrete in piers, abutments and other heavy portions of the bridge, excepting the arch rings which are in good condition.

Probably the work remaining, which will be undertaken in the future, will be advertised for bids on a unit price basis. Ample time is available before any further work can be started and the remaining portion of the project involves normal replacement with little reconstruction.

The replacing of bad concrete under the lower deck will be accomplished by the use of swing scaffolding or the use of barges with tower scaffolding. There is a low dam across the river about 900 feet downstream from the bridge, which maintains a constant water level to a point some distance upstream from the structure. There is normally a 13-foot depth of water underneath the bridge, the water surface being about 20 feet below the lower deck.

The short time remaining after the work could be started and the probable early date of discontinuance, on account of cold weather, presented a problem of organization in order to speed the completion of repairs at the critical points. Fortunately, the mild weather last fall permitted the scheduled work to be accomplished without material interference with our schedule as planned.

Minnesota Highway Safety

Almost 100,000 motorists were arrested or received written warnings from members of the Minnesota Highway Patrol during 1953 for illegal or dangerous driving practices. "The Highway Patrol's activities," said Chief Larimer, "have continued to emphasize safe driving practices and any violation which has been detected by its members has resulted in bringing arrest or warning to the violator. However, the aim of the patrol is not making arrests; this is done only to bring home to the offender that his illegal driving can bring death or injury to other motorists or pedestrians or to himself."

Leading cause for arrest was illegal or unsafe speeds, which resulted in 4,611 motorists being given summonses to appear in court to answer for their actions. Careless driving—a "first cousin"—resulted in 2,152 arrests. Ignoring stop signs—leading cause of serious accidents—brought traffic tickets to 1,948, while driving under the influence of intoxicants resulted in 1,385 arrests.

An indication of the effort being put into the state's safety program is obtained by the patrol's report that 5,589,422 miles were traveled during the year by its members in the performance of their duties.

WATER NEEDS IN A FAST GROWING CITY

C. E. WRIGHT

KEEPING water and electric power facilities in pace with a rapidly expanding population has been a continual problem for Orlando, Fla. With about 52,000 in 1950, Orlando is now believed to be approaching 67,000 with a swollen population during winter tourist months.

Orlando's growth in the 1940-50 decade was more than 40 percent, while Orange County, part of which the Orlando Utilities Commission serves with both water and electricity, increased in population by upward of 60 percent. The continual growth since 1950 is illustrated by the fact that installation of new water meters has been gaining at about 9 percent a year. The number of water meters added during 1952 was 2112, which brought the total to 25,394 on January 1, 1953. Last year another 2500 were installed.

Such "growing pains" have kept the Orlando Utilities Commission applying remedies for a number of years. In 1948, the water pumping and treatment facilities were doubled from 8,000,000 to 16,000,000 gpd. Now the department is engaged in a new expansion project, adding another 8,000,000 gals. capacity to bring the total up to 24,000,000. This program was covered by a $6,000,000 bond issue, issued in 1951, part of which will be used for electrification work.

Not only has the demand for water on a yearly basis been increasing, but the peak loads during dry seasons necessitate provision for extra contingencies. During 1952 the pumpage was 3,494 million gals., an increase from 3,247 million gals. in 1951. More striking, however, was the fact that the peak load for a single day in 1953 was 20,700,000 gal. in June as against a 1952 peak load of 16,506,000 gal. on a day in May. The minimum pumpage, at one time around 5,000,000 gal., now is approaching 10,000,000 gal. For 1952 the minimum filtered water was 6,660,000 gal. on February 17, while the maximum was 17,551,000 on June 12.

In the current expansion program, designed to provide sufficient water for future growth, the Orlando Utilities Commission has engaged in new installations that will take two years to complete. These will cover all phases of the operation.

Orlando's present water supply is obtained from four long-existent wells, sunk to depths varying from 300 to 1100 ft. Two of these can supply 5,000,000 gal. per day each and two provide 3,000,000 gal. per day. These wells will be supplemented by additional wells to be drilled on sites yet to be selected.

There are 42 lakes within the environs of Orlando, and five of these,

● **SECTION** of new 16-in. C.I. pipe used for replacing old 6-in. mains.

situated near the water pumping and treatment plant, are used for raw water storage. A set level is maintained in these within 6 in. by the use of flood gates. With the increasing demand for water, this finished water storage is not going to be enough and will be supplemented by construction of a 2,000,000-gal. reinforced concrete reservoir of standard design for remote control storage, and a pumping station, which will pump finished water back into the mains. There will also be three new overhead storage tanks for finished water, two of 500,000 gals. each and one of 1,000,000 gals. The Taylor Iron Works has built one of the 500,000-gal. tanks; others will be built by the Chicago Bridge & Iron Co.

Although the treatment plant was doubled in size—from 8,000,000 to 16,000,000 gals.—in 1948, the present program will bring it up to 24,000,000 gals. a day. In 1948 two Walker Process Clariflow units were installed. Current expansion includes installation of a third Walker unit together with Builders' control equipment; Palmer sweeps; Wheeler filter bottoms; a 12,000,000-gallon high-lift DeLaval pump for finished water and a 16,000,000-gal. low-lift DeLaval pump, giving a total rated capacity of 32,000,000 gals. for low-lift and 48,000,000 gals. for high-lift.

As the main station of the Orlando Utilities Commission is both an electric power station and a water plant, the condenser water requirements of the electric plant are served from the same reservoirs and recirculated through 86-in. concrete lines.

The expansion program has called for the replacing of a great many water mains with cast iron pipe of larger diameter, as new subdivisions have sprung up and many residential areas have become more thickly populated. Last year's installations called for 174,000 ft. on top of 220,003 ft. laid during 1952. The 1953 installations consisted of approximately 300 ft. of 30-in.; 8000 ft. of 24-in.; 7000 ft. of 20-in.; 28,600 ft. of 16-in.; 10,000 ft. of 12-in.; and 6000 ft. of 8-in. pipe.

Of the 1952 installations, 182,000 ft. were laid by the commission and 37,119 ft. by contractors. With a jeep digger and a crawler for backfilling, the commission increased its pipe laying program over the previous year by 125.9 percent with only a small increase in force.

Water treatment in Orlando involves coagulation and the use of activated silica. Raw water tests show turbidity of 2.2 to 2.7, which is reduced to 0.5 in tap water. Chemicals used last year totaled 2,773,504 lbs. A labor-saving setup has recently been devised for unloading silica trucks. Under the old system of using a pump, approximately nine hours were required to unload one truck. Installation of an air-pressure line cut this to 1¾ hr., saving one man's time of 7¼ hrs. with each unloading. The chemicals used last year were: Alum, 1,377,500 lbs.; carbon, 39,565 lbs.; chlorine, 184,900 lbs.; clay, 300,550 lbs.; lime, 536,250 lbs.; and silicate, 330,739 lbs. Coagulation is achieved by use of alum, silica and clay while lime is used for stabilization. Carbon is added when needed.

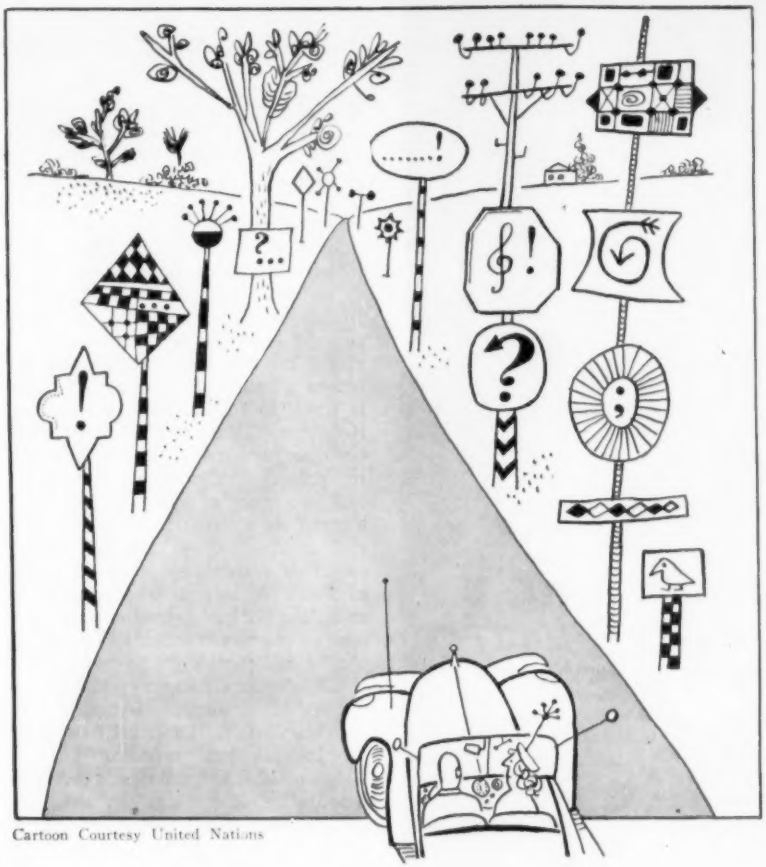
Like many cities in Florida and elsewhere, Orlando's residential growth in recent years has been to a considerable extent outside its city limits. Thus the Orlando Utilities Commission has 4000 water customers in suburban areas. They are charged a little higher rate, recently advanced, than city residents. Inside the corporate limits the rates are: Minimum charge, $1 a month; first 10,000 gals., 25c per 1000 gals.; next 40,000 gals., 20c. per 1000 gals.; next 50,000 gals., 15c. per 1000 gals.; all over 100,000 gals., 10c. per 1000 gals. The new rates for outside residents, effective last August 1, are: Minimum charge, $1.92 a month for 4000 gals.; next 6000 gals., 27½c. per 1000 gals.; next 40,000 gals., 22c. per 1000 gals.; next 50,000 gals., 16½c. per 1000 gals.; all over 100,000 gals., 11c. per 1000 gals.

As of January 1, 1953, the Orlando water distribution lines totaled 1,767,058 ft. Additions completed during the past year bring the total to well over 1,940,000 ft.

The Orlando program is being carried out under the direction of C. H. Stanton, general manager of the Orlando Utilities Commission, with the assistance of L. L. Garrett, manager water department; C. C. Stebbins, superintendent power plant; J. S. De Vane, superintendent distribution, and L. W. Little of the electrical engineering department. The designing and supervising engineers are Robert & Co., Atlanta, Ga.

● **CENTRAL portion of the circular Walker Clariflow unit shown under construction. Capacity is 8 MGD.**

● **NEW 84-inch concrete pipe being installed to provide increased raw water capacity to meet demands.**



Cartoon Courtesy United Nations

The prime function of a highway is to carry traffic efficiently and safely. Lighting and traffic control facilities necessary to do this are described here.

LIGHTING and TRAFFIC CONTROL for PRESENT DAY HIGHWAYS

GEORGE E. MARTIN,

Highway Consultant

SOME kind of traffic control has been necessary since the beginning of traffic operations. Many of the early bridges had signs restricting horses to a walk. Directional and street signs were used and speed limit signs were not unknown. However, the extensive use of various traffic control devices began with the general use of automobiles and the construction of rural pavements about 1920. As the traffic has increased, the traffic control problem has grown by leaps and bounds until it is now a very important function of all street and highway authorities.

Traffic Signs

SIGNS are one of the most important of the traffic control devices. Probably nothing impresses the strange motorist more than good signing while, on the other hand, he quickly resents the lack or poor placement of signs which causes him to get off his route.

Signs may be divided into three general classes namely: guide signs which show route designations, street names, destinations, directions and similar information, warning signs which call attention to hazardous conditions, and regulatory signs which give the highway user notice of traffic regulations at a particular location.

Care should be taken not to install too many signs of the last two classes since they lose their authority if used to excess. Guide signs, however, may be used more liberally since it is always reassuring to see a route marker. It is often valuable to have an engineer not familiar with the route pick the directional sign locations.

Signs may be purchased from commercial producers or may be manufactured by the local or state unit responsible for them. Many organizations use both methods.

The shape of signs has been standardized and is quite generally adhered to. The idea back of the shape standardization was to have the motorist recognize the kind of a sign at a glance from its shape. The octagon shape is reserved exclusively for the stop or yield sign and the round sign is used for rail-

Courtesy West Penn Power Co.

● **EXCELLENT lighting on Elizabeth, Pennsylvania approaches and bridge. Holophane mercury vapor refractors on Westinghouse OV-20 luminaires were used.**

way crossing warnings. The diamond-shaped signs are used to warn of hazardous conditions. Regulatory and informational signs are rectangular. The former usually have the long dimension vertical and the informational signs have it horizontal. Special shapes are used for other special purposes, for example the shield for U. S. route markers.

Sizes of signs have been standardized such as 30 inches by 30 inches for the stop sign except in residence and business districts where 24 inches by 24 inches may be used, where speed is low, traffic is light, and mounting space is limited. Standard sizes have been adopted for most of the numerous signs. Oversize signs may be used but they should be used sparingly in order not to weaken the effect of the smaller signs. Each oversize sign should be a special case and selected on the basis of highway speeds, the degree of hazard and the competition offered by other signs, lighting or displays.

Metal treated with a rust-resistant coating has been used generally for permanent signs. Various special materials such as fiber-glass, plastics, aluminum, waterproof resin-bounded plywood and others are coming into use. The manufacturers are constantly searching for better materials for highway signs. Wooden boards are often used for large signs and for temporary and seasonal signs. Heavy card board signs are adequate for temporary signs for special occasions and emergencies.

Most organizations use a yellow background with black letters or symbols for warning or stop signs. However, the use of a red background for stop signs appears to be slowly increasing. Other regulatory signs have a white background with black letters or symbols. Route and directional markers have black letters or symbols on a white background. There has been a movement recently to use markers of a distinctive color for a particular route through a municipality.

Signs may be illuminated or reflectorized for better viewing at night. The illumination may be by means of a light within or behind the sign illuminating the main message or symbol. A luminous tubing shaped into the lettering or symbol may be used. One or more floodlights may be directed on the face of the sign. Street lighting is not usually adequate for sign illumination but should be taken into consideration when locating plain signs.

Reflectorization may be by means of reflector buttons or units set in the message or symbol. Another method is to use reflective coatings, either on the sign background or, where a black background or panel is used, in the symbol or message. Reflector buttons are made of glass or transparent plastic with lenses or prisms designed to reflect an incident beam of light directly back toward its source. In suitable sizes and spacings they give the visual effect of continuous lines or areas of light. A reflective coating is a surfacing of a retrodirective reflective character often having minute glass spheres (or "beads") closely distributed and embedded in a flexible weather-resistant or painted surface. Each bead acts as an independent reflector button, but in mass effect the beads give the appearance of a uniformly brilliant area when viewed in the headlamp beam. Colors can be reflected by the use of a suitably incorporated pigment. Sheets of polished metal embossed to produce a uniform pattern of small bright spots over the entire surface are also used. Reflective surfaces have been much improved in the past few years.

Symbols rather than words should be used to convey the message where possible. European practice is to use symbols almost entirely. However, the message on most regulatory and information signs

● **OVERSIZE directional traffic signs furnished by A'G'A Division mounted over the roadway on supports manufactured by Union Metal Manufacturing Company.**

cannot be adequately conveyed by symbols alone; some words must be used. Word messages should be as brief as possible. The United Nations has been attempting to have an International system of signs adopted but without success so far.

The sign lettering should be clear, open, rounded capital letters. Most signs should have a narrow border of the same color as the message, just inside the edge.

Normally signs should be individually erected on separate posts, except where one sign supplements another, or where route or directional signs must be grouped. Sign posts and their foundations should be constructed so as to hold the signs rigidly in the proper position so that they will not sway in the wind or be turned or displaced by children or irresponsible persons. Sign posts may be of concrete, metal or treated wood. Concrete or metal posts having holes spaced on 3-inch centers will fit the bolt holes of most regulatory and warning sign plates. For route markers a 1-inch spacing is generally necessary. In some cases, especially in business and residence districts, signs may be placed on existing supports used for other purposes. A portable or removal type of mounting is preferable for men working, school and similar temporary signs. The mounting should be heavy enough so that it will not turn over in the wind and its base should not be appreciably wider than the sign. Noncorrosive bolts, screws and washers should be used for attaching permanent signs to the supports, to prevent discoloration.

Each sign should be displayed for one definite and specific purpose only. The proper signing of streets and highways depends to a very great extent on the experience and good judgment of the engineer responsible for the placement and maintenance of signs. Before any new highway or detour or temporary route is opened to traffic, all necessary signs should be in place. Conversely, signs required by road conditions, restrictions, or temporary routes should be removed as soon as they are no longer needed. This helps good public relations. Changes in traffic characteristics will often call for a revision of the sign requirements. Speed zones, for example, become out of date and should be revised.

Signs generally should be placed on the right hand side of the road and facing the traffic they are intended to serve. In special cases they may be overhead or mounted on channelizing-islands. Reflectorized signs should usually be turned a little toward the road to keep the incident angle of the headlight beams near 90 degrees throughout the range of useful visibility. On grades it may be desirable to tilt a sign forward or back from the vertical, to improve the viewing angle.

Signs on the road shoulder should be placed from 6 to 10 feet from the edge of the pavement or traveled way. Where a raised curb is present the sign may be placed adjacent to the roadway with its nearest edge at least 1 foot from the curb line. Signs in rural areas should be mounted normally at a height of not less than 2½ feet from the crown of the pavement to the bottom of the sign and in built up areas the distance should be increased to 7 feet as a minimum. Overhead signs should not be less than 14½ feet above the roadway and centered over the traffic lanes to which they apply.

Warning signs are generally placed in advance of the condition to which they call attention; stop signs as near as possible to the point where the stop is to be made. Two signs for different purposes should not be placed closer together than 100 feet along the highway. Two signs closely adjacent are difficult to read, especially at high speed.

All traffic signs should be kept in proper position, clean and legible at all times. Damaged, defaced, or dirty signs are ineffective. All signs should be inspected at least twice a year and any that are defective should be cleaned, touched up, or replaced and taken to the sign shop for repair and refinishing or scrapping. Care should be taken to see that weeds, shrubbery and other materials are not allowed to obscure the face of the sign.

Legible signs, properly placed and adequately maintained bring good will to any highway or street department.

Courtesy Minnesota Mining & Mfg. Co.

● **REFLECTORIZED stop and street name signs used in Kansas City, Missouri. Other reflectorized signs control speed and parking on this through traffic street.**

Courtesy Lyle Signs, Inc.

● **STREET signs and button reflectorized traffic control signs.**

Pavement Markings

MARKINGS are used in some cases to supplement the regulations or warnings of other devices such as traffic signs or signals and in other instances they obtain results solely on their own merits. Lines for the guidance of traffic fall into the latter classification.

The most common method of applying pavement, curb and object markings is by means of paint. Paint lines require rather frequent renewal but so far none of the available substitutes has been used to any great extent. Three colors are in common use in the order given namely white, yellow and black. The use of black paint, made with either a tar or asphalt pitch base, has been confined to cement concrete pavements. Approximately 70 percent of the traffic paint used is white. In general, white or black is used for center lines, lane lines, pavement edges, stop lines, crosswalk lines and similar purposes and yellow is used for double center lines on multi-laned pavements and for no-passing barrier lines. Some organizations use white for some or all of these purposes.

Traffic paints are not simple products and no generally accepted technical specifications are in use. State highway departments having laboratories and trained personnel often set up specifications for traffic paint to fit their particular area. They use large enough amounts so that the manufacturer is justified in making a special paint to meet the specification requirements. Even then some require road tests before acceptance or put the final responsibility on the maker. Most other users select one or more reliable manufacturers and purchase the paint from them.

For longitudinal markings the line is commonly 4 inches wide. While solid lines are used, it is becoming general practice to use a 15-ft. dash with a 25-ft. gap. This conserves paint and still gives a satisfactory guide. The relatively short segments give a better line than if longer segments, with correspondingly longer gaps, are used. On the other hand, very short segments and gaps have been found to cause an unpleasant flickering sensation. However, on urban streets the line segments and gaps may be considerably reduced in length since the traffic speed is comparatively low. A solid line should be used always in situations where the line cannot be crossed. Often an additional parallel broken line is used to indicate that the solid line can be crossed by vehicles from that side. Transverse lines on pavements must be wider than longitudinal lines to give satisfactory visibility. Stop lines may have to be as wide as 24 inches where approach speeds are high.

For estimating purposes 15 gallons of paint per mile for a 4-inch solid line is a reasonable figure. For the commonly used broken line the amount may be reduced to 6 gallons per mile.

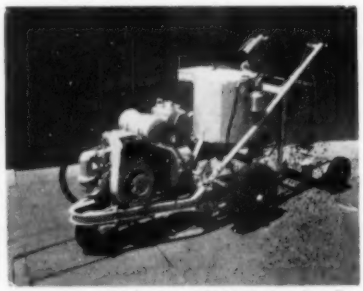
The use of beads to produce a reflectorized line has been increasing every year. The beads may be mixed with the paint or may be applied immediately on the fresh paint. Some users do both. While practice varies, most organizations use about six pounds of beads per gallon of traffic paint. There is practically no additional application cost for reflectorized paint so that the increased cost is only the amount paid for the beads.

The drying time of traffic paints runs between 20 and 40 minutes.

The effective life of traffic paint varies with climate, traffic and the pavement condition as well as the quality of the paint itself. Generally the lines must be renewed about once a year. There are definite indications that reflectorized paint

Courtesy Gledhill Road Machinery Co.

● **MEDIUM size, self propelled power operated striping machine.**



Courtesy Wald Industries, Inc.

● **HAND propelled small striping machine for reflective marking paint.**

Courtesy Traffic Safety Supply Co.

● **TENITE plastic disc traffic line markers on street intersection.**

Courtesy Radiator Specialty Co.

● **RUBBER traffic cones protecting newly painted lines.**

Courtesy Perma-Line Corp.

● **WHITE plastic traffic line on bridge, Harrisburg, Pa.**

markings are somewhat more durable than plain paint under the same conditions. Some users say that the reflectorized lines cost no more than the regular painted ones because of the increased life.

Comparatively little traffic paint is applied by hand except at intersections in cities. Machines have been developed and are available which will apply solid or broken lines, one or more colors, and reflectorizing beads rapidly and efficiently. They may be hand operated, self propelled or attached to a truck. They travel at a rate of from 5 to 10 miles per hour and the crew marks from 20 to 40 miles per day of two-lane pavement. Most organizations use signs or protective devices to guard the wet paint against tracking by vehicles during the drying period. The devices vary from simple home-made wooden blocks to rubber cones, Z shaped guards and pyramids manufactured commercially.

In an effort to obtain more permanent lines, built-in pavement markings of white or colored concrete or inlaid slabs, bricks or blocks have been used. At least one state uses a scored concrete which is not only visible, but produces a distinctive hum or whine when the vehicle tire passes over it. The English have been experimenting with a white plastic poured in a groove in the pavement. A few installations nave been made in the United States.

Pavement markings may also be in the form of small units of metal or other material attached to or set into the pavement surface. Such units may be rectangular, round or special shapes. Metal inserts should have a surface which remains bright under the action of traffic, thus contrasting with the color of the pavement. Nonmetallic inserts should be of permanent white or yellow color. All inserts should be essentially flush with the pavement surface. They should be not less than 4-inches in diameter if round and of equivalent area if of other shape. They should be spaced not more than 16 inches apart, center to center, on transverse lines and 36 inches on longitudinal lines. The most essential requirement is that they are permanently fixed in place by some effective device so that they will not be displaced by traffic. Inserts and flat marker units are used principally in urban areas where frequent repainting is not only costly but causes traffic delays.

Word markings on the pavement may be used for the purpose of guiding, warning or regulating traffic. They should be white and limited to as few words as possible, never more than three. They may be painted or unit letters or symbols may be attached to or set into the pavement. The letters should be greatly elongated in the direction of traffic movement because of the low angle at which they are viewed by approaching drivers.

Reflector markers, consisting of single reflecting buttons, clusters of buttons, small panels covered with reflective coatings, or similar devices are widely used in marking obstructions and other hazards. When used to mark the alignment of the road they are called Delineators.

Delineators consist of reflector units mounted on suitable supports. They should reflect light, of the same color as that of the source, and be clearly visible for a distance of 1,000 feet when illuminated by the upper beam of standard automobile headlights under normal atmospheric conditions at night. The reflectorizing elements or surface may consist of glass or plastic buttons, a glass-bead reflecting coating or other suitable reflecting material. The units should be not more than 3-inches wide by 10-inches high or less than 2-inches wide by 6-inches high. They are usually installed on posts with the unit about 3½ feet above the pavement. The posts are placed from 2 to 10 feet outside the edge of the pavement and spaced about 200 feet apart. Similar results are obtained by inserting reflector buttons in recesses in the concrete curbs.

Photo courtesy Minnesota Mining & Mfg. Co.

● **BEAD reflectorized lines as seen from an automobile at night.**

Traffic Signals

THE traffic signal is a comparatively recent addition to the various means of controlling traffic. As the motor vehicle increased in numbers and speed it soon became evident that something more than signs was necessary. The cities solved the problem for a time by assigning police officers to the intersections. This worked, and is still used, but the manpower required became too much for the financial budget. As in many other instances a machine became the answer. The early traffic signals followed railway practice—first the semaphore and then lights. Practically all signals installed now are lights, electrically controlled.

All traffic signals have a profound influence on traffic flow. They automatically and arbitrarily assign right-of-way and there is no appeal from their decision. Because of their importance to the orderly handling of traffic they should not be installed until a study of traffic conditions at the location has been made. They should also be checked periodically to see that they are properly timed. There is a rather general belief on the part of the public that a traffic signal is the solution for any traffic intersection problem. This may or may not be true and only an investigation at the location can provide the answer.

There are two general classes of traffic signals—fixed-time and traffic-actuated signals. The fixed-time signal is one by which traffic is alternately commanded to stop and permitted to proceed in accordance with a predetermined time schedule. A traffic-actuated signal is one in which the stop and go intervals are varied in accordance with the demands of traffic as registered by the actuation of detectors or push buttons. Each type has certain advantages. Fixed-time is the more commonly used although the use of traffic-actuated signals is increasing. The fixed-time signal is usually cheaper and more simple both in original installation and in servicing. On the other hand the traffic-actuated signal is more flexible and by allowing for traffic variations causes less delay and permits a more efficient use of the traffic channels. It may be used to permit traffic to move continuously on a main thoroughfare except when there are vehicles present on the intersecting street.

The installation of fixed-time signals at intersections should be preceded by a thorough study of traffic, roadway and accident conditions. This includes complete traffic count, with right and left turns, and classification by vehicle type, for at least 8 hours covering the time when the traffic is heaviest. The 8 hours need not be consecutive. Pedestrian volume counts should be made on each cross walk for the same periods. A record of accident experience for a year or more at the intersection is desirable. Details of the physical layout should be assembled on a condition diagram.

To take a simple case, we will study the problem of the intersection of two two-lane streets or highways. In urban areas—a metropolitan region having a population of 5,000 or more—to justify the installation of a fixed-time signal the total vehicular volume entering the intersection from all approaches should average at least 750 vehicles per hour for 8 hours of an average day and that entering the intersection from the minor street must average at least 175 vehicles for the same 8 hours. Traffic during the highest 8 hours will be from one-half to two-thirds of the 24 hour volume. Often the peak hour traffic may be as much as 50 percent higher than the average of the 8 highest hours during the day. These conditions of short duration, so called rush hours, can be handled by controls which have separate timing dials for rush hour demands, by an officer or a traffic-actuated signal where the necessary 8-hour traffic volume does not exist.

Heavy pedestrian traffic will justify a signal for less vehicular traffic. Pedestrian volume crossing the major street should average at least 250 persons per hour for 8 hours and vehicular traffic entering from the major street must average at least 600 vehicles per hour for the same 8 hours and the average vehicle speed must exceed 15 miles per hour on the approaches to the intersection.

For rural intersections the values are 500 vehicles total and 125 vehicles from the minor highway. For pedestrian protection there should be at least 125 persons per hour and vehicular traffic from the main highway 300 vehicles or more and the average speed must exceed 30 miles per hour on the approaches.

When the volume falls below 50 percent of the minimum volume for two consecutive hours or more the signal should be operated as a flashing signal for the period of reduced volume.

Accident hazards may sometimes justify the installation of a fixed-time signal even if the traffic requirements are not satisfied, but such conditions are rare. If an adequate trial of other less restrictive remedies has failed to lower the accident record, and five or more accidents which could be prevented by a signal occur in 12 months, and the traffic is at least 50 percent of the required amount, the installation of a signal may be justified.

Courtesy Automatic Signal Div.

● **TRAFFIC-ACTUATED signals in operation on busy street intersection. Traffic passing over detectors installed in the pavement actuates the signal lamps.**

When considering the installation of traffic-actuated signals somewhat different conditions must be fulfilled. Since these signals do not normally delay traffic, except when it needs to be delayed to avoid conflict with traffic on cross streets, or to maintain traffic movement at regulated speed, it is not advisable to set traffic volume limits. Where the traffic volume is less than required for fixed-time signals, the traffic-actuated signal may be installed if economically justified and the same is true where traffic is heavy only during peak hours. Signals operated from cross streets only, may be justified along some heavy traffic arteries with comparatively low cross street traffic. Where the principal need is for pedestrian protection, the traffic-actuated signal is often best, since it will cause less traffic delay than the fixed-time signal. This is also the case for complicated intersections. It will be noted that the traffic-actuated signal fits many special conditions while the fixed-time signal is the work horse for most installations.

Courtesy Crouse-Hinds Co.

● **FIXED-TIME traffic signals on through highway. Signals have red, orange and green lamps plus right and left permissive turn green arrows at this intersection.**

When it has been decided that a signal is needed and the type has been selected, there are several other things to be considered. The fixed-time signal may be of the nonsynchronous controller type where the operation and thus the timing may vary with the changes in temperature and line voltage. Another kind is the program type which provides for a limited number of changes in cycle length and in the proportions allotted to various "go" intervals. The third is the synchronous controller and finally the master controller inter-connected to local controllers at each signal installation in the system.

The traffic-actuated signal requires detectors and controllers designed to change the signal to Go when actuated by traffic or pedestrians. Several types of detectors are available. Pressure-sensitive detectors are buried in the pavement and actuated by the pressure of vehicles passing over them. Some are operated by vehicles either way while others react to vehicles in one direction only. Magnetic detectors are also buried in the pavement and operate as vehicles pass over them. Sound-sensitive detectors are actuated by sound waves set up by traffic in a metal chamber placed in the pavement. Light sensitive detectors operate by the interruption of a beam of light between a light source and a photoelectric cell. Finally some signals are operated by a pedestrian push button.

The impulse from the detector in the street goes to the controller. These have been developed until they are almost uncanny in their ability to count and time traffic in the various lanes. At this point it is well to have the advice of the manufacturer in determining the type of controller and the location of the detectors.

Regardless of the type of signal the face should have at least three lenses—red, yellow and green located from top to bottom or from left to right in that order. Turn arrows or pedestrian signals, or both, if used should be next in order. All arrows should be green on an opaque background. The lenses should have a visible diameter of not less than eight inches and the green arrow should be distinctly visible at a distance of 200 feet. Lettering should not be used on the lenses since it reduces visibility.

Each lens should be illuminated independently of any other lens, by a clear lamp of not less than 40-watt capacity, especially designed for traffic signals. The signal face should be shielded by visors or hoods so that the approaching driver can see only the intended signal.

In rural areas there should be one or more signal faces visible to the traffic on each approach to the intersection while in urban sections the minimum should be two.

Signals should be located so as to give both drivers and pedestrians a clear and unmistakable indication of the right-of-way assignment. The signals may be suspended in the center of the intersection or placed on far-right and far-left corners of the intersection. Signal faces should be between 8 and 10 feet above the sidewalk or pavement except for center locations where the bottom of the housing should be between 14½ and 15½ feet above the pavement. Maximum visibility should be the guiding principle.

Signal faces should be adjusted vertically and horizontally so that its beams will be of maximum effectiveness to the approaching traffic. Signals should be located as near as possible to the curb line of the street whose traffic they control and in no case more than 10 feet to the right of the pavement or traveled surface.

Signals may be mounted on posts or short brackets attached to poles. Over-the-roadway signals may be on long brackets from poles off the roadway, on cables or on posts or pedestals on islands.

Underground conduit or cable is generally used for signal operation.

Signals should be clean and kept in good operating condition at all times. This will require regular cleaning at intervals of six months or less. So far as practicable lamps should be replaced slightly short of their life expectancy. This time is based on the manufacturers rating and the experience at the particular location. Controllers should be carefully lubricated and the tim-

ing checked at intervals. Signals which are not operating should be hooded, or otherwise marked to indicate that they are out of service.

Great care should be given to proper timing and the selection of cycle length. The cycle should be as short as will accommodate the various movements; 35 to 50 seconds is generally satisfactory for the normal urban intersection while special conditions may require somewhat longer cycles. The division of the time on the cycle must be determined on the basis of conditions at each intersection. Usually about 5 seconds will be needed to clear the intersection. Go intervals of as little as 15 seconds have been used, but more time is needed usually for pedestrians to clear the intersection; 3 to 5 seconds for the yellow and 15 to 20 seconds for the green is a good way to start.

Various systems of coordination of fixed-time signals are in use. The oldest and least desirable is the simultaneous system where all signals show the same indication to the same highway at the same time. The tendency is for traffic to go as fast as possible to pass the greatest number of lights. The simple progressive system uses a common cycle length for each intersection and Go indications are given independently in accordance with a timing schedule designed to permit groups of vehicles to pass at a planned rate of speed without stopping. The flexible progressive system provides for variations in the Go interval at individual intersections for the more efficient continuous movement of traffic at the selected rate of speed. A master controller is used for the operation of the latter two systems.

Special signals may also be used for pedestrians, school crossings, railway crossings and similar situations.

Street and Highway Lighting

STREET lighting was one of the earliest municipal activities. It started with an open flame, passed thru kerosene, gasoline and gas, and now is almost entirely electricity. Most localities will have some lighting so that the problem generally is to improve the present system and plan for extensions. A comprehensive survey of the city should be made noting the location and strength of the present lights, traffic, and accident locations. Data concerning street widths and type of pavement will also be useful. Business districts should be classified as primary, secondary and minor. Residential and manufacturing districts should be noted. All of this information should be marked on a map and we are now ready to decide what we want and design the system. The same data should be collected for planning the lighting of rural highways.

The first thing to determine is the number of horizontal footcandles (lumens per square foot) required on the pavement for the various conditions. Both pedestrian and vehicular traffic counts. Pedestrian traffic may be divided into heavy, such as on main business streets; medium, as on secondary business streets; and light, as on streets in an average residential district. Vehicle traffic in units per hour for the maximum night traffic hour will be used. The number of footcandles to fit the existing conditions can be selected from Table 1. Lighting for open highways should be in the vicinity of 0.3 footcandles and for intersections, circles, cloverleafs, etc., 0.4 footcandles. All of the values should be increased by 20% to allow for maintenance, that is the lamp starts bright and new, but its efficiency does decrease due to accumulated dirt until it is cleaned.

Having obtained the number of footcandles the next step is to determine the spacing of the lamps and their height. As a preliminary we need now to consider the various standard types of luminaires. The vertical cone of maximum candle power is at an angle of about 75 degrees to the vertical in most cases.

Type 1, is a two-way lateral distribution having a preferred lateral width of 15 degrees in the cone of maximum candlepower on each side of the reference line as shown in Fig. 1. The two principal light concentrations are in opposite directions along a roadway. This type is generally applicable to a luminaire location near the center of a roadway where the mounting height is approximately equal to the roadway width.

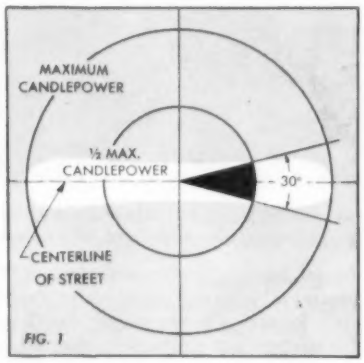
Four-way Type 1, is a distribution having four principal concentrations at lateral angles of approximately 90° to each other as shown in Fig. 2. This distribution is generally applicable to luminaires located over or near the center of a right angle intersection.

Type II light distributions have a preferred lateral width of 25 degrees as shown in Fig. 3. They are generally applicable to luminaries located at or near the side of relatively narrow roadways, where the width of the roadway does not ex-

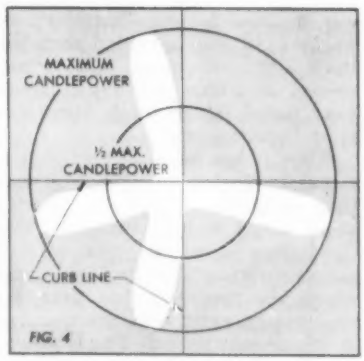
TABLE 1—Average Horizontal Footcandles (Lumens per sq. ft.) for Normal Pavement Brightness

Pedestrian Traffic	Vehicle Traffic-Units per Night Hour			
	Under 150	150-200	500-1200	Above 1200
Heavy	—	0.8	1.0	1.2
Medium	—	0.6	0.8	1.0
Light	0.2	0.4	0.6	0.8

For very dark or black pavements increase the values by 50 percent and for very bright clean white pavements decrease the values by 25 percent.



● **USED over center line of road.**



● **FOR one corner of intersection.**

ceed 1.6 times the mounting height.

Four-way Type II light distributions, shown in Fig. 4 have four principal light concentrations, each with a width of 25 degrees. This distribution is generally applicable to luminaire locations near one corner of a right angle intersection.

Type III light distributions have a preferred lateral width of 40° as shown in Fig. 5. This distribution is intended for luminaires mounted at or near the side of medium width roadways, where the width of the roadway does not exceed 2.7 times the mounting height.

Type IV light distributions have a preferred lateral width of 60 degrees as illustrated in Fig. 6. This distribution is intended for side-of-road mounting and is generally used on wide roadways, where the width of the roadway does not exceed 3.7 times the mounting height.

The Type V light distributions have a circular symmetry of candlepower which is essentially the same at all lateral angles, Fig. 7. They are intended for luminaire mounting at or near the center of a roadway, in the center islands of parkways, and at intersections.

We are now ready to pick an estimated mounting height. It is well to divide the city into districts where conditions are fairly uniform and select the height, spacing and luminaires to be used in each one. Table 2, gives the recommended height for various types. As yet we do not know the lamp size we expect to use, but it can be seen that a height of 25 to 30 feet will not be far wrong, with the greater height for the stronger lamp.

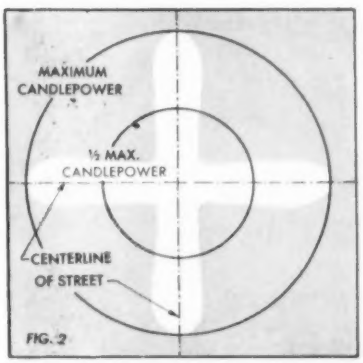
TABLE 2—Recommended Minimum Mounting Height for Luminaires

Lamp Size	*Distribution Type*			
Lumens	*I*	*II*	*III*	*IV & V*
2,500	25 ft.	20 ft.	20. ft.	20 ft.
4,000	25	25	25	25
6,000	25	25	25	25
10,000		25-30	25-30	25-30
15,000		30	25-30	25-30
20,000		30	30	25-30
25,000		30	30	30

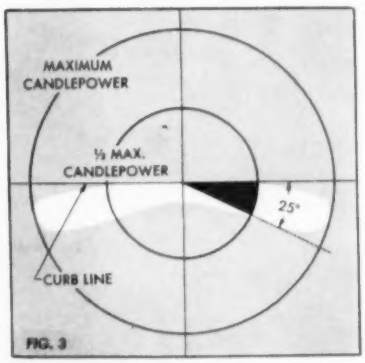
Having selected the height and type the next job is to lay out the lateral distribution of the individual lights. Intersections should be planned first, since they are hazardous and of prime importance. For regular two-street intersections, locate luminaires along normal lines of sight beyond the intersection and beyond pedestrian crosswalks. For narrow intersections one of the four-way types may be used. For three-way or T intersections, one luminaire should be located at the dead-end opposite the street entrance. Irregular intersections must be given special treatment. Luminaires located near the curb line between intersections are usually staggered on opposite sides of the street if possible. The horizontal spacing for various types will be from 5 to 7 times the mounting heights for types I and V and 5.7 times the mounting height for types II, III and IV.

We now have all the data necessary to pick the lamp size or number of lumens obtained by dividing (Spacing times Road Width times Ft-Candles) by (Total Coefficient of Utilization). Curves for obtaining the coefficients of utilization are shown in Fig. 8. To see how the formula works, assume we have available the following values:

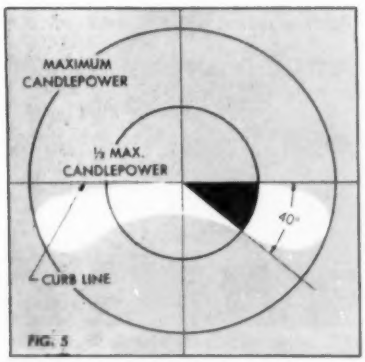
Footcandles Required	0.6
Street Width	50′
Mounting Height	25′
Luminaire Overhang	5′
Spacing	130′
Luminaire	Type III



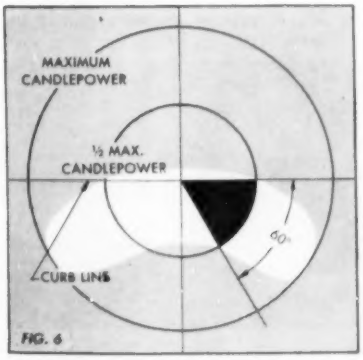
● FOR center of intersection.



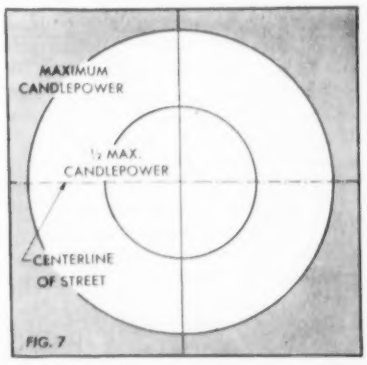
● ON side of narrow roadway.



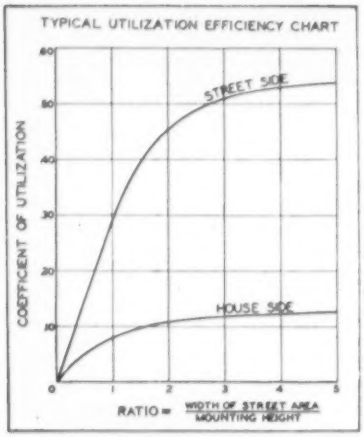
● ON sides of medium width road.



● FOR use on sides of wide road.



● MOUNTED in center of roadway.



● **Fig. 8—CURVES used for obtaining the two coefficients of utilization.**

To use the curve of Fig. 8, first calculate the ratio for the "street side"= street width/height. Substituting: 45/25=1.8. Ratio for the "house side"=width of house side area/height. Substituting: 5/25=0.2. Now enter the curve of Fig. 8 and obtain the two coefficients which are: Utilization Street Side=0.432 and Utilization House Side=0.025 the total Utilization Coefficient being 0.457. Substitute in the general formula:

$$\text{Lumens} = \frac{130 \times 50 \times 0.6}{0.457} = 8534$$

The next largest standard lamp would be used which in this case would be 10,000 lumens.

There is a choice in selecting the light source such as the filament lamp, the mercury vapor, the sodium vapor and the fluorescent. The filament lamp permits excellent control with simple optical systems, operation is easy and the wattage range is wide. The mercury vapor lamp generates about twice as much light as does the filament lamp of comparative wattage and has a much longer life. The bluish white color that is produced is objectionable in some locations. The color can be modified if necessary. The sodium vapor source produces a warm yellow light and is commonly used for isolated lighting, grade crossings and special traffic control locations. Fluorescent lights give high efficiency of generation, low brightness, relatively long life and enhanced visibility on wet pavements, but require larger reflectors and protection in cold weather. Some extensive installations have been made recently.

Refractors are a very important part of the luminaire combination since they put the light on the street. Three basic types of prisms are commonly incorporated in refractors; those which bend transmitted light rays, reflecting prisms which return light rays to the luminaire and diffusing prisms which scatter transmitted light. Many modifications and combinations of these prisms are used to produce the exact vertical and lateral light distributions required to shape the light to the street or area to be illuminated. The refractor and the light source should fit together and it is best policy to consult the manufacturers to see that the best combination is selected.

Luminaires are usually mounted on brackets supported by metal or concrete poles. Many types and styles are available.

Some means should be provided to extinguish the lights in the morning and turn them on again in the evening. Time clock, photo-electric, pilot wire, carrier relay, radio and manual controls are used.

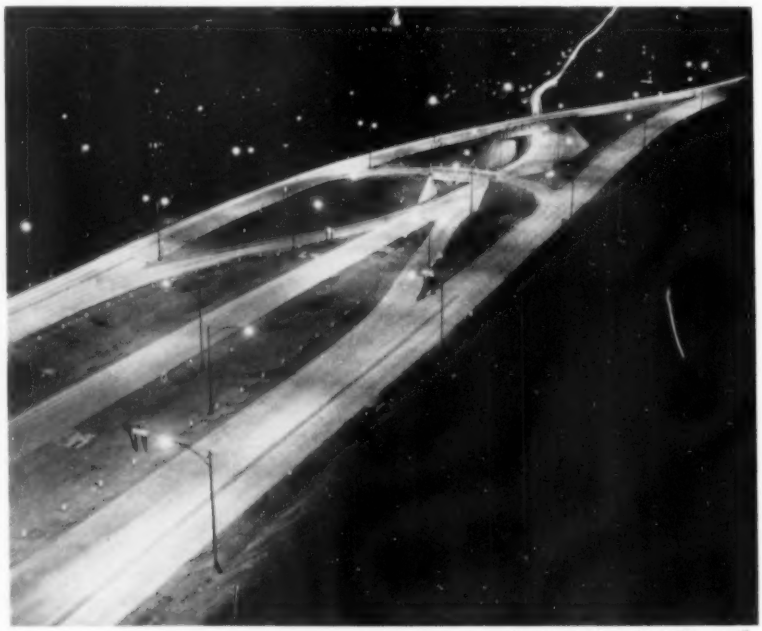
Maintenance is an important part of any lighting system. Group replacements of lamps are often made periodically depending upon the expected life of the lamps. Glassware is cleaned annually in about half the cities and semi-annually in the others except for some very clean, or very dirty, municipalities where the cleaning is done oftener.

References

Manual on Uniform Traffic Control Devices; Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., 75 cents.

Pavement marking; Highway Research Board, 2101 Constitution Ave., Washington 25, D. C., 30 cents.

American Standard Practice for Street and Highway Lighting; Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y., 50 cents.



Courtesy West Penn Power Co.

● **WELL DESIGNED and executed modern lighting system on a bridge approach.**

● **OLD TYPE lighting on wide street in Richmond, Virginia.**

Photos courtesy Westinghouse

● **SAME view after installation of new improved lighting system.**

HIGHLIGHTS

of the OHIO DEPARTMENT OF Highways Report

AS usual, the annual report of the Ohio Department of Highways contains much information of value. Here are summarized some of the experiences and procedures that may be of value to other highway organizations.

The Aerial Engineering Section of the Department was the first completely integral aerial mapping organization of its type in the United States. It has continued to expand its capacities since its inception early in 1946.

It is of interest that aerial photogrammetry has recently demonstrated its usefulness through the complete preparation of a set of final construction plans for a new highway in the vicinity of the Atomic Energy Plant in Pike County.

During the calendar year, photographic aircraft flew approximately 50,000 miles and exposed 2,599 aerial photographs which resulted in 7,865 contact prints, 1,229 enlargements, 96 topographic bridge site plans, drainage maps, one complete construction plan and other valuable engineering services.

● **AERIAL photograph taken by the Aerial Engineering Section for the relocation of State Route 161 at Big Walnut Creek in Franklin County, Ohio.**

Photo Laboratory

Requests for taking pictures resulted in 158 assignments during the year, with nearly 700 photographs being taken. In addition, the work has included the furnishing of film, developing 1250 rolls of films, 235 film packs and 1600 cut films; printing and enlarging 48,000 photographs from 2¼″ x 3¼″ to 30″ x 40″ size; making 320 duplicate negatives and 1200 offset press negatives; and preparing 530 lantern slides and 75 translights.

In addition to the above, three operators continued the work of the microfilm section inaugurated in late 1951. Cost of this service varied with the condition of the file and the type of documents. The total cost embraces the re-arranging of files, removing of paper clips, fasteners and staples. This preparation in some instances consumed 70% of the total time used. The cost of this service varied from .00057¢ to 0.01¢ per document, depending on the condition of the material. In all, 1,405,213 documents were copied on 375 rolls of film, using reduction ratios of 37:1 and 18:1. This work resulted in a saving of space from that occupied by 432 file drawers (1670 cu. ft.) to a volume of 2.97 cu. ft., the space used by 375 rolls of film.

Construction Bureau

Particular attention has been directed to the improvement in techniques for the construction of embankments and subgrades. This is considered important because the entire pavement life depends upon a stable subgrade. Tests were made on two projects to determine the economies and benefits which could be obtained in the compaction of soil and granular material with pneumatic tired rollers weighing up to fifty tons loaded. The results have been promising, and changes have been made in the Specifications to allow contractors to use this equipment. Consultant service has been rendered in the treatment of landslides and special sub-surface drainage problems encountered during construction.

Maintenance and Repair

Through careful administration of the limited amount of maintenance funds, and by efficient work in the field, the State has kept its roads in serviceable condition. There continues to be, however, a gradual deterioration in pavements and structures that can be retarded only by performing work of a more permanent nature than can be expected under routine maintenance. The State recognizes this condition and is continuing to reconstruct sections of low sufficiency, and to place bituminous resurfacings of one inch or

● **GROUP of trainees in office portion of aerial survey training program.**

more on pavements that are showing distress under traffic. Bridges that are structurally weak are being replaced, or repaired, either under construction contracts or by maintenance forces. Total work placed under contract during the year was approximately $48 million, of which maintenance contracts amounted to about $7 million.

As stated in the foregoing, emphasis was given during the year towards keeping existing pavements in serviceable condition. In addition to close attention to routine maintenance of sealing cracks, patching surfaces, correcting unsatisfactory subgrade conditions, installing subgrade drains, and making pavement replacements at failures, the following bituminous work was performed:

Seal treatments were applied by maintenance forces on 206 miles of pavements at a cost of $186,847, and by contract on 1,166 miles at a cost of $1,045,036. Road-mix or drag treatments were applied by maintenance forces on 24.1 miles at a cost of $63,270, and by contract on 537 miles at a cost of $1,877,787. Treatments done by maintenance were generally light. Hot-mixed, hot-laid asphaltic concrete was placed by maintenance forces on 2.53 miles at a cost of $13,861, and by contract on 439 miles at a cost of $3,443,341. Only isolated short sections were done by maintenance. Also 29.87 miles of brick pavements were sealed by maintenance forces at a cost of $26,480.

Bituminous dust treatment was applied by maintenance forces on 242.2 miles at a cost of $36,584, and by contract on 148 miles at a cost of $52,383. That done by maintenance was largely spot work.

Prime treatment was applied by maintenance forces on 20 miles at a cost of $12,187.

The shoulders of highways were given close attention, especially in keeping them flush with the edge of pavement to permit traffic to use them when necessary without undue hazard, and in sloping them away from the pavement to prevent any ponding of water at the pavement edge. Approximately 65,000 tons of aggregate were placed on shoulders as required by local conditions. About 1000 miles of high shoulders were dressed and ditches reshaped. The overall condition of shoulders and ditches has improved considerably during the last several years.

A large amount of maintenance work is performed under maintenance contracts. The present policy of the Highway Department is to use the contract system of performing maintenance work whenever possible. The principal items that are generally let to contract are surface treating, placing road mixes and bituminous concrete, guard rail erection and painting, culvert and small bridge construction, and bridge painting. During the year the Maintenance Bureau maintained a force of approximately 4500 men, which is about 500 less than in 1951. Temporary employment is generally given to several hundred men during the summer months for such seasonal work as weed cutting, pavement striping, guard rail painting and painting of miscellaneous minor structures.

Testing and Research

Approximately 956,000 tons of bituminous concrete were manufactured under the supervision of the Laboratory. Also, technical assistance was lent the Construction Bureau in the design and control of portland cement concrete mixtures for approximately 1.5 million sq. yds. of base and pavement and approximately 250,000 cubic yards of concrete for structures.

In the field of research and materials studies, the Laboratory studied materials such as reactive aggregates when combined in concrete with high-alkali cements, waterproofing compounds, pigmented curing compounds, and air-entraining cements to the end that concrete may be made more resistant to frost action and to the various materials that are used in winter to free the highways of ice and snow.

Pavement Marking

Pavement markings in the form of center lines, lane lines, and no-passing lines provide valuable visual aids to orderly traffic movement and the safety, comfort, and convenience of driving, particularly at night. White center lines and lane lines, consisting of 15-foot painted dashes spaced 25 feet apart, were painted totaling 13,500 miles, all of which was reflectorized by glass beads.

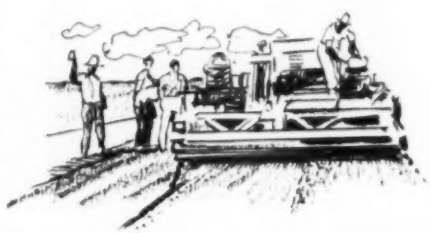
In addition, 250 miles of reflectorized double yellow center-lines were painted; 5400 miles of reflectorized yellow no-passing lines were painted to mark zones where over-taking and passing is unsafe because of limited sight distance.

The paint required amounted to 89,000 gallons of standard white paint, and 96,000 gallons of standard yellow traffic paint. A total of 185,000 gallons of paint and 980,000 pounds of beads were required at a cost of $304,000 for paint and $94,000 for beads. The total cost of pavement marking, including labor was approximately $616,000. Special non-centerline painting such as railroad crossing symbols, stop bars, school, cross walks, and obstruction markings, totaling $60,000, are included in this total.

Six motorized striping machines were used for pavement marking.

Training Program

The Highway Training Program was established in 1949 to carry out the Department of Highways' policy of filling vacancies and new positions by promotion. Trainees are selected by the supervisor of the program and each is then assigned to one of the fifteen different offices of the Department. The trainee is given field and office experience, rotating from one phase of the work to another up to the time he completes his registration as a professional engineer. The trainees receive experience in the various phases of highway engineering, depending upon their past experience, interests, aptitudes and opportunities available.



APWA News

AMERICAN PUBLIC WORKS ASSOCIATION
1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Richards Names Chairman of National Committee on Urban Transportation

APWA Representative Will Direct Development of Planning Manual

The need for comprehensive studies of urban transportation problems has been recognized by many municipal officials for a number of years. The appraisal of these problems is certainly no simple task. Effective planning and design requires the employment of a wide range of technical knowledge and methods and the gathering and keeping of a great variety of factual data.

A National Committee On Urban Transportation has recently been organized to develop a manual for the guidance of cities in the conduct of such urban transportation studies. Its aim is to develop practical procedures which will produce the essential data upon which to base legislation, plans, fiscal policy and design within the framework of a city's normal administrative structure.

Glenn C. Richards, General Superintendent, Department of Public Works, Detroit, has been named to represent the American Public Works Association on this Committee. He was elected Chairman of the Committee at the organizational meeting held in Chicago, May 11. Action was taken at this first meeting to invite the Automotive Safety Foundation to cooperate with the Committee in carrying out its objectives. Other organizations that are represented on this Committee are the American Municipal Association, American Society of Planning Officials, Municipal Finance Officers Association, International City Managers Association and the National Institute of Municipal Law Officers.

1954 Membership Campaign is Launched

Offner speaks at Reno meeting.

The State Chairmen of each Area recently met on call of the Area Vice Presidents to map plans for the 1954 membership campaign. The Central Area Meeting was held in Chicago, March 31st. The Eastern Area Meeting was held in New York City, April 7th. The State Chairmen of the New England States made preliminary plans at this meeting to hold a New England Public Works Conference in Brookline, Massachusetts in the near future. The Southern Area Meeting was held in Birmingham, Alabama, April 14th in conjunction with the Annual Meeting of the Alabama Chapter of the APWA.

The Western Area Meeting was held April 21st, in Reno, Nevada. With but two exceptions all states were represented at these meetings. The rapid climb in membership during the first quarter of the year plus the enthusiasm shown at these meetings indicates that 1954 will be another banner year for the Association.

Big Equipment Show Is Planned for Atlantic City

Leading Manufacturers in the Public Works Field will be Represented, Exhibition will Feature Displays of Latest Equipment and Materials

The 1954 Equipment Show which will be held in conjunction with the Annual Public Works Congress, September 19-22 in Atlantic City, promises to be the largest ever sponsored by the Association. Over fifty of the country's leading manufacturers of public works equipment have purchased exhibit space with four months still remaining before the opening of the big show.

The enthusiastic response that has thus far been displayed indicates that equipment manufacturers are looking forward to this outstanding event. The unexcelled opportunity afforded at this forthcoming exhibition to observe the latest equipment developments and discuss problems with top-flight equipment representatives makes this a major attraction of the congress.

Atlantic City's Convention Hall, site of 1954 Equipment Show.

APWA CHAPTER ACTIVITIES

Birmingham, Alabama: Sam Lasseter, Commissioner of Public Works, Gadsden, Alabama was elected to succeed John L. Stamps of Birmingham as President of the Alabama Chapter at a Meeting held in Birmingham, April 14 and 15. The meeting was held in conjunction with a conference of the Southern Area State Chairmen. Mayor Jimmy Arrington, of Collins, Mississippi was the featured speaker at the banquet. Wade Bradley, Commissioner of Public Improvements for Birmingham spoke on the need for coordination between city departments. Other speakers included William Xanten, Superintendent, Division of Sanitation, Washington, D. C. and O. L. Shrader, Traffic Engineer, Montgomery, Alabama.

Rockville Centre, New York: The Spring Meeting of the New York-New Jersey Metropolitan Chapter, attended by nearly 250 members and guests, heard a discussion of "Plain Facts on Salvage in Today's Municipal Refuse Program". Speakers were Casmir Rogus, Director of Engineering, and Maurice Feldman, Sanitation Engineer, both of New York City's Department of Sanitation. Inspections were made of Rockville Centre's salvage operations and land reclamation projects followed by tours of municipal parking fields and other facilities of the Village. In addition, a wide variety of equipment was displayed by manufacturers and equipment distributors.

Philadelphia, Pennsylvania: The April Meeting of the Metropolitan Philadelphia Chapter featured an interesting talk by Richard Overmeyer, Assistant Traffic Engineer and a movie entitled "Worlds Series Pictures, 1953". The movie was presented by Ira Thomas, Former Catcher for the Philadelphia Athletics.

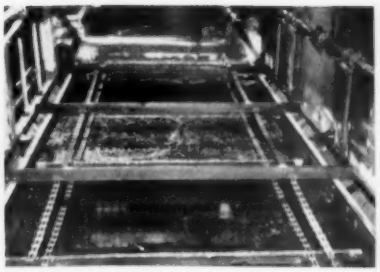
New Orleans, Louisiana: Forty members and guests were present at the April Meeting of the New Orleans Chapter to hear Mr. Charles Pearson, Jr., District Manager of the Southern Bell Telephone and Telegraph Company speak on "The Miracle of Radio Relay". Mr. Pearson defined the microwave and showed how it is used in the transmitting of telephone conversations and television programs.

Detroit, Michigan: Carl Walker, Coordinator of Community Relations for the Detroit Department of Public Works presented a movie at the April Meeting of the Michigan Chapter showing how the City of Detroit uses salt in its ice control program. James F. Duncan, Manager of the State and Municipal Sales for the International Salt Company also presented interesting slides of salt mine operations.

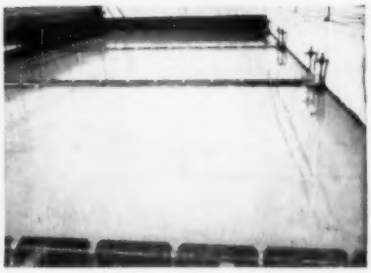
Oakland, California: B. P. Bellport, Construction Engineer for the United States Bureau of Reclamation was the speaker at a luncheon meeting of the Northern California Chapter, April, 16th.

(Continued on page 110)

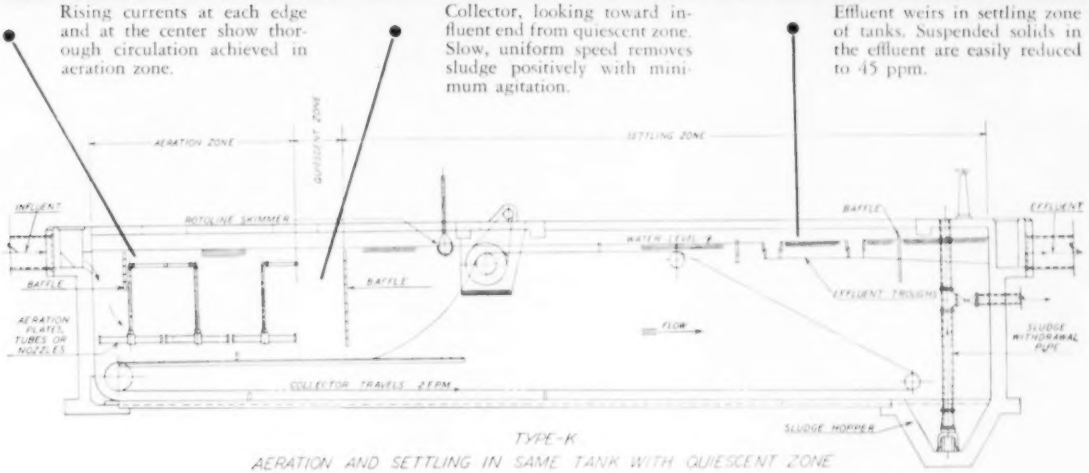
Rising currents at each edge and at the center show thorough circulation achieved in aeration zone.



Collector, looking toward influent end from quiescent zone. Slow, uniform speed removes sludge positively with minimum agitation.



Effluent weirs in settling zone of tanks. Suspended solids in the effluent are easily reduced to 45 ppm.



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Using only the correct volume of air produces a more gentle agitation. This increases flocculation . . . helps release more entrained gases . . . improves suspended solids settling rate . . . steps up B.O.D. removal. Even when chemicals are added to the sewage, proper mixing rate for maximum flocculation can be used. Sedimentation in aeration zone will not be a problem.

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For complete information on pre-aeration and other efficient equipment in the broad Link-Belt line, call the Link-Belt office near you. An experienced sanitary engineer — working with you, your chemists and consultants — will help you get the finest in modern sewage, water or industrial waste treatment equipment. 13.342

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SANITARY ENGINEERING EQUIPMENT

Washington news

Presented in cooperation with the American Public Works Association and through the courtesy of the Washington Office of the American Municipal Association.

Speed-Up In Public Works Planning

Reliable Washington sources have released information that President Eisenhower has ordered a speed-up in public works planning for use in an economic emergency. Retired Major General J. S. Bragdon, formerly deputy chief of the U. S. Corps of Engineers, has been made head of a special planning unit. The Administration has asked for a special $35,000 appropriation from the Congress to finance an increase in staff personnel. The new unit will work closely with the Council of Economic Advisors which is the agency designated by the President with overall responsibility for the matter.

So far the order just covers the drafting of plans and blueprints. No immediate expansion in Federal public works is expected. Detailed plans are being drafted in order that projects can be started in short order if business gets worse. Congress has already authorized a reserve of $12 billion in Federal public works. About 1/12 of this has reached the blueprint stage.

Although Federal public works spending may be increased some over the $5.5 billion originally planned by President Eisenhower for fiscal '55, the President still believes state and local governments should do the bulk of any expanding public works as an anti-recessional device.

Federal-Aid Highway Act of 1954

The biggest Federal-aid highway authorization bill in U. S. history has passed both Houses of Congress. The bill authorizes a total of $1,932,000,000 by authorizing $966 million for the Federal-aid highway system for each of the two fiscal years 1956 and 1957.

The urban authorization was increased from $137.5 million per year to $175 million for each of the two fiscal years—a total of $350 million. AMA was the *only* national organization representing states or municipalities to testify in either or both Houses of Congress during this important session of Congress when this historic bill was being written.

Besides the funds for urban road projects, the following amounts were authorized for each of the two fiscal years 1956-1957: Primary roads—$315 million; Secondary roads—$210 million; and an increase from $25 to $175 million for the Interstate System. An additional $91 million was authorized for forest highways, forest roads, park roads, parkways, Indian trails, public land roads, the inter-American highway and the Rama Road.

In addition to upping the authorization on the interstate system from $25 to $175 million per year, the 50-50 allocation formula was changed to allow the Federal share of such projects to be as much as 60%, with local government's share being 40%.

The new bill makes clear the fact that the interstate system goes *through* municipalities and not just *to* them. AMA-suggested language was adopted clearly stating that funds for the interstate system are allocated for use on the whole system, *"including extensions thereof through urban areas"*.

One half of the funds for the interstate system will be allocated on a population basis. This helps urban and metropolitan areas. The remaining half of the $175 million authorization will still be distributed according to the traditional formula. Sums apportioned under the Act remain available for local matching for two years after the close of the fiscal year for which they were authorized. The bill allows a permissive transfer of funds between the Primary, Secondary and Urban systems in an amount not to exceed

10% of a state's allocation. Such transfers may be approved by the Secretary of Commerce upon request of the Governor.

The bill also reflects a great concern for highway research. The Secretary of Commerce is authorized to perform several important studies including:

(1) A comprehensive study of all phases of highway financing, including a study of the costs of completing the several systems of highways and of the progress and feasibility of toll roads with particular attention to the possible effects of such toll roads upon the Federal-aid highway program.

(2) A study of the problems posed by the necessary relocation and reconstruction of public utilities services resulting from highway improvements. This study, to be undertaken in cooperation with State highway departments and other parties in interest, will go into finances, franchise agreements, state laws and intergovernmental highway relationships.

(3) Frequent consultation with the Federal Civil Defense Administrator relative to the civil defense aspects of highways to be constructed or reconstructed.

(4) General research on all phases of highway construction, reconstruction, modification, financing, design, development, maintenance, safety, traffic conditions, state laws, use-development-testing of new materials, and desirable weight-size standards for vehicles using public highways.

(5) Study of a suggested draft of a bill or bills for a Federal highway act which will include such provisions of existing law as are now on the books, and any changes or new provisions which the Secretary deems advisable. This draft is to be submitted by December 1, 1954.

(6) A study of the feasibility of the Great River Parkway, a super highway to traverse the Mississippi River Valley.

• • •

USDA Modifies VE Quarantine Affecting Interstate Movement of Swine

Once-a-week cleaning and disinfecting of feed, water, and rest stations and facilities used in the interstate movement of swine has been determined to be adequate in preventing spread of vesicular exanthema, the contagious swine disease, and will be permitted by the U. S. Department of Agriculture in a modification of a VE quarantine regulation in effect since November 1953, which required cleaning and disinfecting of such stations and facilities after each use by swine moving interstate.

The change, effective April 1, was made largely because of the success of efforts of most swine-shipping States to control feeding and marketing of raw and uncooked garbage—considered to be the source of vesicular exanthema—within their borders. The disease has not been reported in any major stockyard for some time, and there has been no infection reported in swine that have moved through feed, water, and rest stations during the past six months.

Vesicular exanthema has been a national problem since June 1952. Quarantines are imposed when the disease is found, to prevent its spread and thus protect farmers in other areas against heavy losses. Federal VE quarantines are in effect in areas of California, Connecticut, Maine, Massachusetts, New Jersey, New York, Pennsylvania and Rhode Island.

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Congressional Support For Federal Public Works Facilities Administrator Grows

A spate of bills to establish an "effective program for the planning and construction of needed public works and to create the Office of Public Facilities Administrator," have hit the hopper in both houses of Congress. Starting with S-2913, introduced by Senator Douglas; at least the following companion bills have been introduced in the House: HR-7766 (Bolling), HR-7866 (Rhodes), HR-8290 (Buchanan), HR-8523 (Sullivan), HR-8586 (Byrne), HR-8250 (Kelley), HR-8354 (Kee), HR-6362 (Lane), have been introduced.

Main features of the bills include: (1) Appointment of a Public Works or Public Facilities Administrator, by the President; (2) Provision of Federal assistance in the form of direct grants or loans to States, counties or municipalities in building public works; (3) A 55-45 formula, with Uncle Sam putting up 55% of the funds for such works; (4) An appropriation of $3 billion is authorized for carrying out such purposes. All of the bills are now pending in the Public Works Committees of both Houses. Action is not expected unless the economic situation worsens. The measures are an indication of Congressional attitudes, however, and are a guidepost to future Federal action in this regard.

• • •

Reports of APWA Chapter Meetings

(*Continued from page* 104)

He showed colored slides of the Monticello Dam Project and discussed the construction details and significance of the project to that area. The dam is scheduled for completion in October, 1956 and will impound 1,600,000 acre feet of water. It is located in Putah Creek in Napa County. The water will be used to irrigate some 7,000 acres of farm land.

Los Angeles, California: A panel discussion of the Los Angeles County Storm Drain Program was one of the highlights of the April Meeting of the Southern California Chapter. The proposed improvements involve 140 storm drain projects, located in 44 communities throughout the county. Carl E. Johnson, of the California Department of Industrial Relations spoke on "The Responsibility of Supervision Under the California State Safety Orders". Another feature of the program was an interesting panel discussion on the use of plastic pipe in underground piping and conduit installations.

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Monotube Lighting Poles **UNION METAL**

Good Engineering and Inspection—

Important Factors in Street Work

MARION E. BORISS,
City Engineer, Chattanooga, Tenn.

BECAUSE the part that engineering plays is important in any street program, it is essential to have adequate engineering assistance. There are several sources from which engineering skills may be obtained. If the community does not have a full-time engineer staff, it is best to call on a consulting engineer; and in some cases where there is a regular city engineer, with a number of assistants, it may be best to use a consulting engineer on specialized work or for very large jobs. The city engineer cannot be a specialist in all branches of engineering; nor can he readily expand a small regular staff several times over to handle a large job that will last no more than perhaps a year.

Assuming that proper engineering service has been obtained, the basic work can begin. It may be desirable to have a preliminary investigation and report to determine whether the program planned is feasible and desirable, or is economically possible. If required, such a report would (1) Define the problem; (2) outline possible solutions; (3) recommend a solution or a study in more detail of the two or three most promising courses; (4) estimate the cost; and (5) discuss methods of financing, with recommendations.

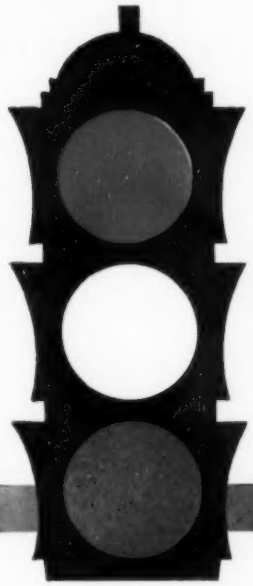
A discussion at a Street Clinic Sponsored by the Tennessee Municipal Advisory Society at Cleveland, Tennessee.

A consulting engineer may be retained to make such a report, without any commitment as to future employment. However, it is usually advantageous to the city to have the consultant who has prepared a satisfactory preliminary report retained for the design and construction program since much of the background material he has collected and studied will be valuable in carrying out the program.

If preliminary report is omitted, as will be the usual case in a street improvement program for which money is available, the steps in procedure would be about as follows: (1) Determination of the amount of money available; (2) preliminary street selections; (3) surveys, plans and specifications; (4) cost estimates; (5) final project limits; (6) notifications of utilities; (7) contract documents; and (8) advertising, bidding and award of the contract.

In determining the amount of money available, some thought should be given to a program which will be attractive to contractors. It is to the city's advantage to have as many contractors bid as possible. The program should be large enough, if possible, to allow an out-of-town contractor to move a plant into the locality. This factor will be influenced by the type of work and

(*Continued on page* 122)



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PHOTOGRAMMETRY *in City Planning*

LOUIS A. WOODWARD

Vice-President

Jack Ammann Photogrammetric Engrs., Inc.

● **AERIAL photograph made while mapping the City of Dallas, Texas.**

UNLIKE an old automobile, blighted sectors of a city cannot be discarded when they are worn out. We must rebuild and patch up the weak spots before they infect adjacent areas. Otherwise, the results of low assessed valuations will, in time, bankrupt a city or overtax its healthy areas until they, too, succumb.

Good planning is not possible without a complete inventory of existing facts clearly presented in graphic form. The unhappy situation in which many cities find themselves today is, to a great extent, the result of inadequate maps. In most cases, numerically speaking, there are more than enough maps already available, but the map information is not properly coordinated. It is not uncommon to find as many as half-a-dozen different maps in use in a city, the majority of which are at different scales and so distorted that even the street pattern cannot be compared. A good set of maps showing graphically all of the necessary social, economic, physical, and topographic features clearly presents most of a city's problems and makes coordination of all of the city's activities possible.

● **TOPOGRAPHIC map shows contours and structures of area marked on aerial view.**

In the past the cost of obtaining this map information has been almost prohibitive; however, through photogrammetry it is now possible to secure this much needed data at prices cities can justify.

Three basic types of maps, in addition to an aerial photographic mosaic, enlargements, and contact prints, will supply most of the map information required for efficient operation by all departments. The first basic type of map required is called an "area map" or "general map" and will be at a scale somewhere between 1″=2000′ and 1″=4000′. This map should cover an area at least 5 miles in all directions beyond the city limits. In states where township and county planning laws have been passed, this type of map should be extended a few miles beyond the township or county boundaries. This map should show main drainage systems, railroads, roads, streets, parks, schools, neighborhood shopping centers, police and fire stations, airports, and possibly a few other items. It is particularly important that this map be all on one sheet or on the fewest number of sheets possible in the case of large cities. The map should be designed and drafted to permit reproduction at smaller scales as small scale copies are necessary for many purposes. A map showing

only this information can be used for a great many purposes. However, for effective use, a number of photographic linen reproductions must be made upon which special purpose data may be recorded. For example—one linen reproduction of the basic map may be used to delineate existing land use data; another zoning data; and others for transportation facilities; through streets; utilities; commercial and residential development; census tracts; civilian defense, and the likes. In some cases two or more of these subjects may be shown on one map. By having this necessary data all compiled on the same basic map at the same scale the relationship between the various subjects can readily be noted and general plans made for correcting existing problems and planning for a better future. The "area" or "general map" need not be to any extremely high degree of accuracy as it is not used for accurate measurements. A tracing of a reasonably good mosaic will provide all of the accuracy necessary.

Topographic Maps

The second basic type of map required for efficient city operations is a topographic map. The Departments of Public Works and Engineering have the greatest use for this type of map. These maps range from 2-ft. contours at a scale of 1″=100′ to 10-ft. contours at a scale of 1″=400′. For most cities a topographic map showing 5-ft. contours at a scale of 1″=200′ provides adequate over-all information, although 1-ft. and 2-ft. contour maps are frequently necessary for problem areas. The various uses of this type of map dictate standard accuracy. However, engineering uses of topographic maps are by no means the entire use of a topographic map by cities. They are very effectively used by the City Plan Engineer in subdivision control, and in developing and adjusting zoning regulations, and also by the Building Inspector in considering building permits.

The third type of map is one that is sometimes called a "tax-map" or a "block map". This map will generally range in scale from 1″-50′ to 1″-200′. There is no agreement among city officials regarding the accuracy of this map or the detail to be shown. Some city officials are of the opinion that the map should be a diagram type map although it must be compiled to a reasonable degree of accuracy, while others insist it be extremely accurate. This map, like the "area" or "general" map, is used for a wide variety of purposes. The information shown on this base map are the legal width of streets and alleys, railroads, property boundaries, and the lot and block numbers. The lot and block numbers are keyed to a card file which shows property ownership, dimensions, improvements, and other data as may be required.

Use the Same Scale

Photographic linen reproductions of the "tax" or "block" map are used to show utilities such as water mains, gas lines, electric lines and sewers. When all map users in the city use the same basic map, operations are easily coordinated. On the other hand, if gas mains are shown at one scale and water mains at another it is almost impossible for any coordination between these two features.

By current aerial photography all of the various types of maps and map information may be kept up-to-date. In some cities new air photography is a well justified expenditure every two years, however, in other cities that are developing more slowly new photography is not required in less than 5 to 10 years. The new photography and mosaics are used for a wide variety of purposes in

addition to bringing the three basic maps up-to-date. For example, it is extremely important that cities maintain rate of growth statistics. By making a house count within each census tract it is easily possible to apply the necessary factors and to determine growth data for each census tract from each new set of photographs.

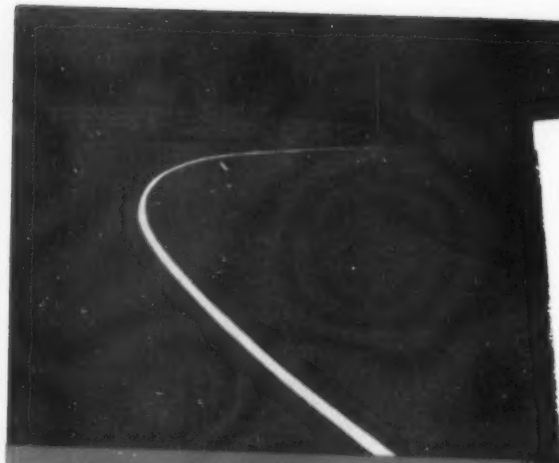
How Good Maps Help All City Departments

By having up-to-date map information available, a city's future problems are at the finger tips of the administrators, planners, and engineers and adequate provisions can be made currently to save millions of dollars in future operations and development. As an example of this, if a developer files a new subdivision plan which shows a sanitary sewer only sufficient to provide for the proposed subdivision and the city's general plan calls for further development in this area, appropriate arrangements can be made with the developer to install larger main sewers in order to provide for subsequent development. This same item applies to storm sewers, gas mains, electric transmission lines, street widths, and many other items.

If adequate maps are not available, re-appraisals must be made frequently to discover the changes that have taken place. One city in the Southwest, with a population of about 25,000, spent over $53,000 in three years on tax appraisal surveys and evaluation study. Without proper maps, public works, engineering, tax, zoning administration, subdivision control, and in fact most of a city's functions pay heavily for accumulative errors. Many cities are faced with the dilemma of either allowing fringe satellite developments to incorporate as a separate municipality or annex them and shoulder years of financial burden. In the United States last year 402 municipalities annexed additional territories totaling almost 300 square miles. It is of paramount importance that city and county governments have the necessary maps upon which current and long-range urban and rural problems can be accurately and systematically studied in order that the maximum possible service may be provided.

Generally speaking, city planning is like an insurance policy for insuring economic stability. Dividends resulting from sound planning far exceed the annual cost.

This is an abstract of a paper presented at a meeting of the American Society of Photogrammetry.



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Wald Industries, Inc. is a leader in the field of highway striping machines and equipment. Wald's Reflecto-Liners, developed from years of experience, research and testing, are the most versatile kind of equipment of this type that is available on the market today. Whether your striping job is marking the nation's super highways or marking cross-walks, parking areas, etc. in your own community, there is a Wald Reflecto-Liner made to meet your particular requirements. Designed to handle plain or reflective traffic paints with ease, the Reflecto-Liners are capable of laying single, double, even triple lines—in either a continuous or skip line, in one or more colors.

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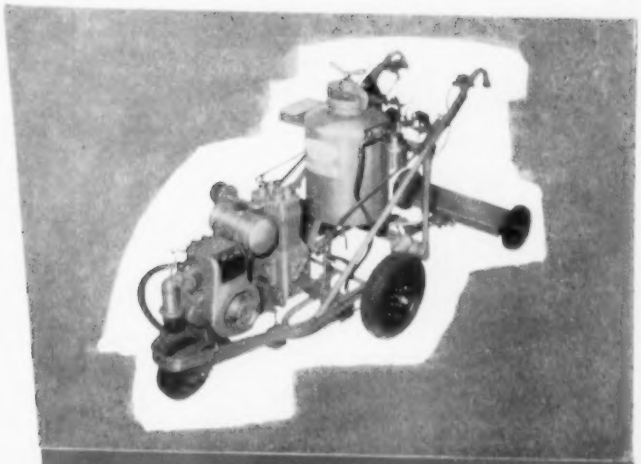
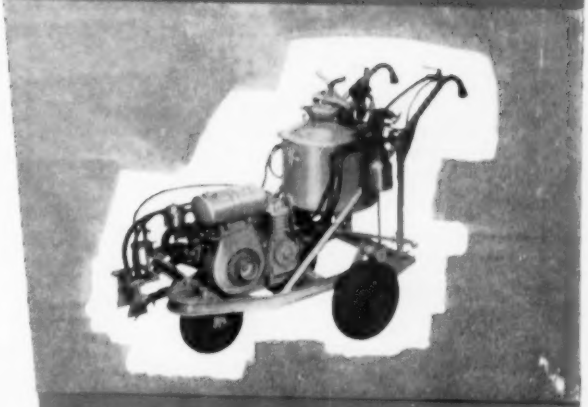
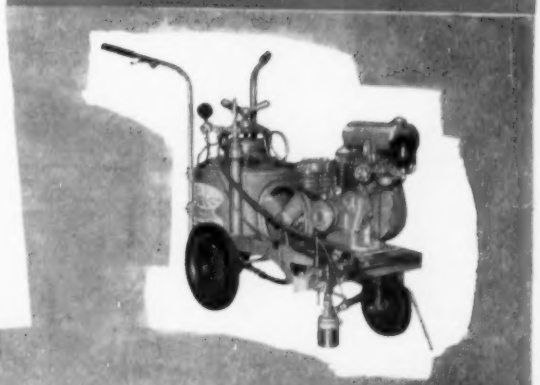
See for yourself how these valuable machines can be an asset to you. **Write today for a copy of the new Wald catalog—General Catalog W-10.**



MODEL 12—Light, fast and easily handled. A self-propelled, single-line machine that can apply either reflective or plain paints in 2" to 6" lines. A 100% air reserve keeps this machine working continuously without strain.



MODEL 8T—For both town and industry. Highly maneuverable. Lays clean-cut lines of reflective or plain paints in 2" to 6" widths. A 50% air reserve makes this Reflecto-Liner an efficient striper as well as a compact and portable source of air.



REFLECTO-LINER, Jr.—Big-machine performance in the low budget class! Hand-propelled and lays reflective or plain paint lines of 2" to 4" widths to within inches of raised curbs or walls. Gives brilliant performance at a very low cost.

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Now's the time to mail this month's Readers' Service card.

Engineering and Inspection

(*Continued from page* 112)

the general level of construction, that is, whether contractors are busy or are looking for work. It may be to the city's advantage to put its street money for several years into one contract or to issue bonds which would be serviced by the annual allotment of money to the program.

After the money available has been determined, a preliminary selection of streets to be improved should be made; often these two steps may be combined to a certain extent. The engineer will make a preliminary layout on which will be designated primary or arterial streets, secondary or feeder streets, and finally local streets. Usually the primary streets are state highways and need not be further considered. This leaves the first program (or the first few programs) to be concerned with any primary streets which are not state highways, and with secondary streets. The engineer can recommend and assist the governing body in this phase of the planning. The street selection should be made by the elected officials on a priority basis insofar as is possible.

After the streets are selected the engineer will make a detailed inspection and the necessary surveys to determine the requirements to bring the street up to the desired standard. From this study he will make up his estimates and fit the program to the allotted money; the governing body will be informed; and recommendations will be made as to the type of improvements. This is the time to decide on curb, gutter and/or sidewalk on utility extensions or replacements that are necessary or desired; and whether any major reshaping or regrading is necessary or desirable.

During this time the engineer will investigate also the suitability and availability of local material. This may have a great influence on cost. Every effort should be made to use local and native materials. Estimates should be made on various types of construction, and on combinations of materials. Usually alternate bids are taken to evaluate these.

Selecting the Program

From the foregoing estimates, the final selection of the program will be made. At this time the utilities involved should be notified and requested to perform the work deemed necessary. Their attention should be invited to any grade change or relocation; known deficiencies should be pointed out. Railroads should be notified of any crossings involved;

digs 17¾ feet deep . . . dumps at 10 foot height

With its long, deep reach, Koehring ½-yard 205 hoe digs 17¾ feet below grade . . . has 10-foot clearance height at beginning of dump to load trucks. Maximum cutting width, with side cutters, is 32 inches. During the hoist-and-swing cycle, close-coupled dipper pulls up tight to boom, avoids spillage. Powerful cable crowd, fast line and swing speeds maintain big-yardage production. Heavy-duty, box-section boom and dipper arm resist side-sway in toughest digging. Operators like the 205's ease of operation . . . *you'll* like its EXTRA WORK CAPACITY. Here are some of the heavy-duty advantages you get that increase production with every 205 attachment:

Big 20-inch main drum clutches.

Only 2 major shafts in upper machinery . . . simple, accessible.

Heavy-duty splined shafts . . . carburized, hardened gears.

4 hook-rollers, eccentric adjustment.

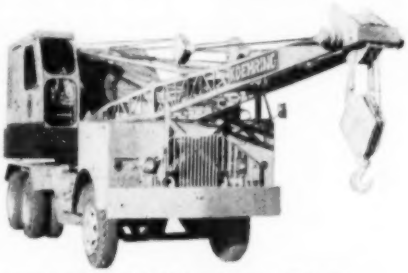
Automatic crawler traction-brakes.

Standard or extra-long crawlers . . . with 16, 20, or 24-inch shoes.

Independent traction . . . optional.

Antifriction power-flow for dig, hoist, swing, travel.

Crawler-mounted 205 brings you: ½-yard dipper capacity as a shovel or hoe . . . ½ to ¾-yard bucket capacity as a clamshell or dragline . . . 10-ton lift crane.



Truck-mounted 205 has 15 tons lift capacity, 25 to 55-ft. boom, plus max. 30-ft. jib. Travels 32½ m.p.h. Converts to all standard excavator, crane attachments.

Get the complete story on this new 205. Ask your Koehring distributor for details, or write for bulletin.

To: KOEHRING CO., Milwaukee 16, Wis.

Send us bulletin on the new ½-yard, 15-ton 205.

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and as soon as possible they should be given a detail showing the type of crossing that will be required of them, with any track adjustment necessary.

Plans, specifications and contracts documents are prepared and the governing body selects the time and place of receiving bids. The engineer will try to pick a time early in the season before the contractors are loaded with work.

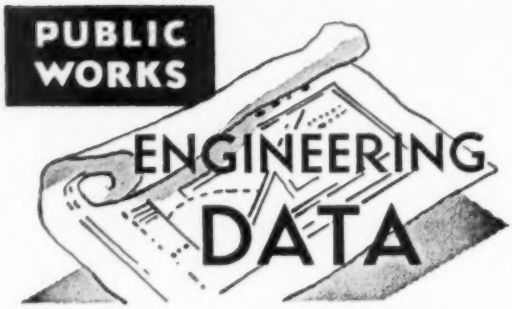
Upon receipt of the bids, the engineer will tabulate them, evaluate alternates, and made a recommendation as to the award. The governing body will have as much latitude as it desires, within legal limitations, in selecting the contractor and type of construction. The engineer will usually recommend the contractor who submits the lowest bid on the type of construction desired, provided he has evidence that the contractor is qualified to do the work.

In all of this work, the engineer will consult the city attorney on all questions pertaining to local law and ordinances, making sure that the city is protected from a legal standpoint and that the provisions of all laws and regulations pertaining to the work have been met. Bidders will be required to conform to registration laws and to submit proper bid bonds. The successful bidder will be required to furnish adequate performance and liability bonds. After the contract is awarded the engineer will prepare contract documents which will be approved by the city attorney. A work order will be issued, and the project will be under way.

At this point I wish to emphasize the importance of a clear understanding between the city and the engineer on responsibility for supervision of construction. Some cities, not being familiar with the usual agreement with a consulting engineer, may assume that supervision of construction is included in the design fee. It may or may not be—at least to the degree that the city may expect.

I strongly recommend that the consultant be retained on a complete supervision basis. All consultants prefer this as they then have the assurance that their design is carried out as they conceived it. If a city has its own inspection force, this may be incorporated under the consultant's resident engineer and the fee reduced accordingly. The consultant should have complete responsibility for design and construction.

(*Continued on page* 146)



Cost of Laying Cast Iron Water Pipe in Maine

The excellent report of the Augusta, Me., Water District, for 1953, S. S. Anthony, Superintendent and Engineer, lists costs of water main construction. There were 1,986 ft. of 6-inch pipe laid during the year, with 11 6-inch gate valves. Average costs were $3.00 per ft., including 60 cents for labor; 28 cents for equipment; $2.08 for materials; and a small amount of "other charges." The costs per foot for this pipe ranged from $2.42 to $5.63—the latter for a 40-ft. long line. Mostly, the costs were very close to the average. The longest line was 608 ft.

For 8-inch pipe, of which 4,010 ft. were laid, the average overall cost was $4.20 per ft. This was broken down to 93 cents for labor, 40 cents for equipment, $2.76 for materials and a very small amount for "other charges." The 554 ft. of 10-inch pipe cost an average of $11.10 per ft., of which materials accounted for $7.30 and labor for $3.40. The 480 ft. of 2-inch pipe cost only 58 cents a foot. The 8-inch lines included three gate valves, and the 10-inch line four gates.

Cost of Laying Water Mains in Toledo

During 1953; the Toledo Division of Water constructed 19 water lines having a total length of 14,341 ft., or an average of 755 ft. each. Total cost of all lines was $80,211.25, of which 49.5 percent was for materials and 50.5 percent for labor. The average cost of 6-inch lines, according to the length of line was:

For lines 500 ft. long or less, $6.40 per ft.; for lines over 500 ft. but not over 1,000 ft. long, $5.25 per foot; and for lines over 1,000 ft. long, $4.45 per ft. These average costs include valves, hydrants and other necessary appurtenances. The cost of engineering services for these lines was computed and amounted to 6.24 percent of the total cost, not including overhead; and including 20 percent overhead, the total cost of engineering was 7.49 percent of the cost of the work.

These data were furnished us by Paul M. Kiel; George Van Dorp is Commissioner of Water and B. R. MacRitchie is Director of Public Service.

Keeping Ferry Channels Free of Ice

According to the British magazine Highways and Bridges tests have been made by the Swedish Board of Roads and Waterways to keep channels across lakes free of ice by installing pipes along the bottom of the channel. Compressed air coming out through holes in the pipes moves the warm bottom water to the surface and the channel will not freeze. Pipes of plastic were found to be best.

PUBLIC WORKS DIGESTS

THE HIGHWAY AND AIRPORT DIGEST

Reinforced Brick Pavement in the Netherlands

Steel reinforcement in vitrified brick pavements is being tested in the Netherlands, a test section in a brick yard being followed, in October, 1953, with one on one of the National Roads which carries a traffic of about 2,000 vehicles a day. Loading tests showed that the spreading of the load diminished the unit pressure on the sand base to about 1/10 of the unit pressure on the pavement surface. The paving brick were 3⅝ x 7⅝ in. by 3⅜ in. depth. The 5/16 in. reinforcement was placed in parallel longitudinal lines 8 in. apart.

"De Gewapende Klinkerbestrating." By C. Ortt. *Wegen* (Netherlands), February.

Special Signs on Virginia's Highways

In general, the Virginia Highway Dept. maintains uniformity in signing, marking and signalization work. However there are isolated cases, where, despite all normal precautions, accident rates soar or the motorist is abnormally confused. Here, special studies are made and special signing features adopted. Use is made of king-size standard shoulder signs, overhead signs suspended from cables or trusses, highway illumination of both the sodium vapor and incandescent types, special pavement markings and messages, and three-unit type delineator posts. Oversize reflectorized signs are 5 x 5 ft. Overhead signs were formerly suspended from cables spanning the road; but in 1950 the engineers designed a truss made of pipe welded to form a triangular cross-sectional truss frame and vertical supports. This is painted aluminum or dark green, depending on the background, and is illuminated at night. About 12 of these have been erected to date, in advance of intersections to guide the motorist or warn of junctions with high accident rates. In one location, change from standard shoulder-type signs to an overhead sign reduced wrong turning by motorists from 15% to 1½%.

In one specially dangerous combination of hill, curve and bridge on U. S. Route 1, an oversize curve warning sign and safe speed marker were erected 600 ft. in advance of the curve, a reflectorized striped warning sign was placed on the outside of the curve at the P.I. and the entire curve was outlined with signs 30 ft. apart; about 300 ft. of guard rail was installed just in advance of the bridge; and approach, curve and bridge were completely illuminated. This reduced the accidents from 23 to 3, fatalities from 3 to 0, and property damage from $22,590 to $2,250. At another location, use of oversize stop signs reduced failures to stop from 24% to 7%.

"Virginia Tackles Problem Loca-

Traffic Control in a Colonial City

Williamsburg, Virginia was the capital of the province in the days before the American revolution. A section of the old city has been restored as near as possible to its original condition. Every effort is made to recreate the appearance and atmosphere of an important colonial city in the days when Washington, Jefferson, Patrick Henry and others were laying the foundation for these United States. Yet it must be kept open to the public so that they can see how life was lived in those early days. The two ideas conflict in many ways and traffic is one of them.

Many of the crowds of visitors come in automobiles and control of traffic in the restored area is a problem. Some of the cross streets are very narrow and this adds to the difficulty. Traffic lights would not fit in with colonial surroundings so there are none. Rather inconspicuous signs are used to protect the principal thoroughfares.

Main dependence is placed on encouraging tourists to park their cars and use a free bus system to get around. Ample parking space is provided and the buses operate at frequent intervals throughout the restored area at no cost to the user.

● Stop sign at main intersection.

● Bus stop at Governor's Palace.

THIS BIG YELLOW MACHINE

SAVED YELLOWSTONE COUNTY $1.12 PER HOUR

Compare these figures from Yellowstone County, Montana!

Yellowstone County owns Cat-built Motor Graders and motor graders of competitive manufacturers—eleven in all.

Operation costs for the Caterpillar No. 12 Motor Grader pictured here showed that, for 12 months, it cost $1.12 per hour less than the next closest comparable motor grader of competitive make. And it cost $3.11 per hour less than motor grader C. Figures include depreciation, wages—everything. These are not Caterpillar statistics. Yellowstone County kept complete cost records on the maintenance of 2000 miles of roads.

Here are the county's records for three of their machines—all purchased in 1950:

- **Caterpillar No. 12 Motor Grader . . . $5.60 per hour**
- **Motor Grader B . . . . . 6.72 per hour**
- **Motor Grader C . . . . . 8.71 per hour**

Figures for two machines purchased in 1941 are as follows:

- **Caterpillar No. 12 Motor Grader . . $6.45 per hour**
- **Motor Grader D . . . . . 7.92 per hour**

All of the Caterpillar machines—regardless of the date of purchase—cost less per hour than *any* of the six competitive machines. Even Yellowstone's 15-year-old Cat* No. 12 Motor Grader cost $2.55 less per hour to operate than a competitive machine only three years old!

Figures like these are no surprise to Caterpillar owners. From experience, they know all Caterpillar Motor Graders are built to run less expensively—built to run longer at less cost with less down time than any other competitive make.

See your Caterpillar Dealer for further facts on how he can help you stretch your tax dollar. Call him today.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

tions Through Special Signing Treatments." By Herbert R. Perkinson, Jr., Assoc. Traffic & Planning Engr. *PUBLIC WORKS*, May.

Freeways in California

California highways, especially those in and near San Francisco and other west coast cities, are among the most heavily traveled in the country. To carry this traffic safely, the Division of Highways is building freeways by the score. In the San Francisco Bay area alone, 140.5 miles of freeways, 14 in number, have been constructed at a cost of $67,018,000, and 237.4 miles are under contract or projected. The right-of-way costs have been $77,077,000. These are described briefly in this article. (Another article in the same issue describes in detail a recently opened freeway in Salinas). The 1952 State Legislature provided funds for advance acquisition of right-of-way on routes through areas of potential or imminent development, thus saving millions of dollars which would have been required for this purpose after real estate values had decreased. The advance right-of-way acquisition fund has been increased to $30,000,000 and made a revolving fund. The author explains that most of what are called "freeways" are really expressways built to freeway standards with the exception of permitted crossings at grade, designed so that they can be converted to true freeways when funds are available and traffic warrants.

"Bay Area Freeways." By B. W. Booker, Asst. State Highway Engr. *California Highways*, April.

New Extractor Determines Bitumen and Moisture

Success of a paving mixture depends to a large degree on a uniformly controlled gradation of aggregates and a consistently proper amount of asphalt. Methods and equipment for determining bitumen content studied by the Materials and Research Dept. of the California Div. of Highways were found to involve complicated manipulations, inflammable or toxic solvent, lengthy calculations, difficulty in extracting certain types of mixes, excessive time required, and uncertainty of reliability of results in many cases. The division's engineers have developed an extractor which is portable, comparatively simple to operate, and gives dependable results, including bitumen content, moisture content, and gradation of aggregate, in less than four hours. The process consists of two stages: (1) removal of free moisture by distillation and condensation in a moisture trap, using Stoddard solvent instead of xylene; (2) removing the asphalt-laden solvent through filter paper by the use of compressed air, and flushing the sample with clean solvent. The extractor and sample drier are described; the remaining equipment are all standard items. The procedure promises to provide an efficient and accurate method for all types of bituminous mixes.

"Determining Bitumen and Moisture Content of Bituminous Mixes by a New Field Type Extractor." By Ernest Zube, Super. Materials & Research Engr. *California Highways*, April.

Retention of Aggregate In Surface Treatment

Experiments were conducted in the laboratories of the Dept. of Civil Engineering A & M College of Texas to study the effect of certain vari-

ations in procedure on the retention of aggregate by asphalt in surface treatments. These experiments verified that the proper quantity of a given aggregate for a one-course surface treatment can be determined from the quantity required to cover one square yard one stone thick, plus an allowance of 10 per cent for spreading inaccuracy. They revealed also the importance of uniform grading, dry condition, and lack of dust. If two aggregates are much the same in price and quality, the aggregate having the closer grading is the better.

Wet aggregate depends upon construction conditions. These control success or failure of its use. If the aggregate is rolled wet and the surface turned over to traffic while the aggregate is still wet, then excessive loss of aggregate due to whip off under traffic would be expected. On the other hand, if wet aggregates are used during hot, breezy weather and are rolled after being thoroughly dry, then the retention should be nearly as good as if dry aggregates are used. Dusty aggregate causes poor retention even with the dust quantity small. Wetting the dusty aggregate aids retention provided that the aggregate is dried before rolling.

When asphalt cements are used as binders for surface treatments, the stone must be placed as soon as possible after the asphalt is applied. The harder asphalt cements hold the cover stone more tightly, but it is more difficult to get initial retention of the stone. However, adhesion of stone to asphalt cements is improved by heating the stone to 150° to 200° F.

"Retention of Aggregate by Asphalt Surface Treatments." By Fred J. Benson and Bob M. Gallaway, Research Engrs. *Roads and Streets*, April.

Other Articles

"An Asphalt Plant for a Small City" (Cheboygan, Mich.) By Donald L. Brown, City Mgr. American City, April.

"Economies in a Highway Relocation." How the bypassing of Arlington by the Oregon Trail will affect the town. By Guy Browning Arthur. PUBLIC WORKS, May.

"Fast Stone Production for Turnpike Base." Seven special plant set-ups for crushing 3,000,000 tons of stone for the West Virginia turnpike. Roads and Streets, April.

"Temporary Traffic Stripe Solves Highway Problem." Use of strips of heavy roofing paper lightly cemented to the pavement. By W. T. Rhodes, Assoc. H'way Engr., California Div. of H'ways. California Highways, April.

"Flared Guard Railing Reduces Accidents at Bridge Approaches." By R. J. Israel, Asst. Traffic Engr. California Div. of Highways. California Highways, April.

"Soil-Cement Stabilized Roads in Britain." Abstracts of several papers. Contractors Record (England), April 7.

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Football Field Design

(*Continued from page* 83)

was felt that this, as mentioned before, would provide a positive drainage table when covered with a granular material—in this instance coarse sand.

To pick up the subgrade drainage, as well as the surface drainage, we decided on a peripheral storm sewer system which would serve the football field, track, and parking areas (some laterals were to be designed later as the outlying areas are developed). The 8-in. and 10-in. pipe are 16, 18 and 20-ft. lengths of

Cross Rolling*?
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Contractors report averaging more than 60% higher tonnage compacted per day with 3-axle tandems than with 2-axle tandems doing similar work. Published records show 3-axle surface roughness indices are as much as 50% lower than state averages. And many states specify fewer rollers, less rolling time when you use Buffalo-Springfield 3-Axle Tandems!

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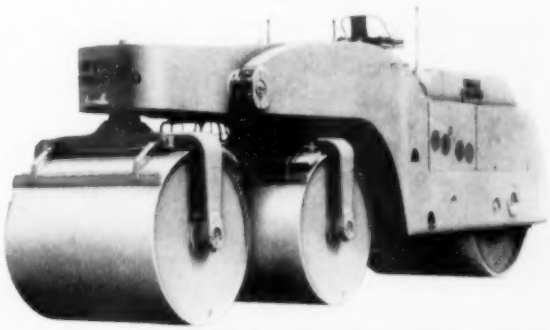

Buffalo-Springfield 3-axle tandem

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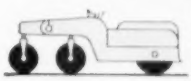
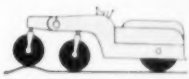


1. Both guide rolls are suspended from a single rotating beam. When the beam is "semi-locked," the end guide roll can pivot above but not below its normal position.



2. When the first guide roll encounters a high spot in the fresh material, the Walking Beam rotates to permit the first guide roll to pass over the hump exerting only its normal pressure. This "prepares" the material for the high compaction of the center guide roll.

3. Then the center guide roll rises on the hump. The "semi-locked" Walking Beam causes the entire guide end of the roller to rise with the center roll. This lifts the end guide roll off the ground, transfers its weight, along with some of the weight of the *drive* roll. At this instant, the center roll exerts *almost 3 times its normal compaction*.

4. The drive roll exerts its normal compaction as it passes over. The Walking Beam can be used unlocked for rolling vertical curves and warped surfaces. Can also be used fully locked, if desired.

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asphalt coated perforated metal pipe. Perforated pipe was chosen to allow the water coming off the pitched subgrade of the field to infiltrate. For the short offtake line connecting with the existing sewer 15-in. reinforced concrete pipe was used. This line is at present to be serviced by 10 manholes with surface drain covers. The manholes adjacent to the sides of the field have curb-type inlets, the cast iron backs of which are to be part of the track curb.

Sprinkling System

We wanted the sprinkling system to be modern, effective, and economical—especially in relation to operation. This facility came in for a great deal of study. All the commercially available systems were investigated. The coaches were consulted. We finally decided on a detachable sprinkling-head type that would not leave any objectionable surface hazard.

From here we designed the layout and sizing. As the field was several hundred feet from the nearest water main we had to come in with 4-in. pipe to conserve pressure, which is about 50 psi at our source. We decided to use mechanical joint cast iron pipe in the 3- and 4-in. sizes; and not wanting to overplay our luck with the slightly flexible mechanical joints we put blocking at all joints to prevent uneven settlement in our troublesome red clay.

Straight lengths of soft copper pipe were selected for all sizes under 3-in. Copper was chosen for its superiority in resisting corrosion and for its ability to maintain pressure on long runs. Even though we planned the system for self drainage we thought it advisable to use soft copper for its ability to withstand a considerable amount of freezing without bursting. This consideration is important to us where the temperature drops to 30° below zero at times during the winter.

The advantage of using straight lengths rather than coiled pipe is easily appreciated when one sees the difficulty of trying to straighten and lay to a nominal grade such sizes as 1½-in. type "K" copper. Even though there is a coupling to sweat on every 20 ft. the laying goes fast and there is a large saving in labor with a much better job assured.

The peripheral storm sewer trench and the sprinkling line trenches were excavated to grade by our Gradall with a 24-in. trenching attachment. As the backfill material for the sprinkling line trenches was to be sand, we decided to use lateral bleeding trenches backfilled with coarse rock, from each of the sprinkling risers to a run-out point on subgrade. Even though the sprinkling line trenches were all built to a self-draining grade it was considered advisable to relieve a possible congestion caused by heavy downpours.

The sod and salvaged topsoil are to go on a coarse-sand lift, varying from 12 ins. at the center to 24 ins. at the sides. The lift is to serve a twofold purpose—to give rapid absorption to downpours and keep the surface material away from the trouble-making red clay. It was felt also that this construction would minimize ground fog.

In order to have a rich enough base for a healthy turf we are going to reclaim 4 or 5 inches of the stripped topsoil and lay cut sod on that. In trying to arrive at a balance between passage and retention of surface water it was felt that a reasonable thick topsoil pad should be used.

We decided to use sod rather than grow turf for two reasons. One of the most important was that we could not expect to have the field

in shape next fall by seeding. Another was that in the final analysis there did not seem to be any saving costwise. Then too, seeding for a highgrade turf can be an uncertain venture.

The track was designed more or less to conform with standard practice. It also will have the advantage of a subgrade drainage table pitched toward the storm sewer trench. Details can be picked off the plan.

Progress

As of now (December) the grading has been completed to a width of 224 ft. (just about half way into the track) and to a length of about 400 ft. (30 ft. beyond the ends of the football field). The storm drains and manholes are in, the water lines laid, and trench backfilling completed. All is according to plan.

During the winter we are going to place the sand lift as opportunity permits. This will be completed by spring so that the reclaimed topsoil can be spread promptly. The valves for the detachable sprinkling heads will be installed and the cut sod placed so that the turf will be in good shape for football in September. During the same period the track curbs and track will be built.

Also, in the planning stages as of now, a grandstand with a seating capacity of 3500 is to be built before the show can go on.

• • •

Controlling the Use of Air-Conditioning Water

Since, during the three hot months of the year, water use for air-conditioning in Elko, Nev., amounts to 20 percent of the water consumption, a degree of regulation has become necessary. A recent ordinance has been passed allowing the use of water from the mains for compressor-type cooling units of one and a half to five tons capacity if equipped with water cooled condensers. Such units of five tons or more must be equipped with evaporative or similar type condensers. The use of water from the mains is prohibited for compressor type units of less than one and a half tons capacity. There are also other restrictions on the use of city water as a principal cooling medium.

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Adequate Roads

(*Continued from page* 18)

sections in Illinois—good idea, we think. Aside from a bus trip from Evanston to the Chicago Midway Airport, we seemed to get around rather easily. The bus trip was rugged, and we had a real "cowboy" at the wheel. While in Milwaukee, had a wonderful plane ride—to Madison and back—with hospitable Harry Seaman of Seaman Motors. Harry even let us "fly" the airplane for a few minutes—nothing to it, kids, nothing to it. Disappointed that nothing is actually under way on the Milwaukee Expressway as yet, although the feasibility studies have long since been completed. Rumor has it that disagreement over construction specifications is partly to blame. The inconsistencies of modern travel were again clearly demonstrated. Using public transportation, it took nearly as long to go from LaGuardia Field to West Englewood, New Jersey (15 miles) as it did to fly from Chicago airport to LaGuardia. It was our first visit to the new Airlines Terminal Building in Manhattan, at 38th Street and First Avenue; it's a beauty. Its location is quite convenient, since it's fairly close to Grand Central and to the Manhattan end of the Queens-Midtown Tunnel.

Urban Toll Highway—What will be the country's first major urban toll highway may soon be a reality. This is the Seattle Crosstown Parkway, which extends across the north end of the city from Puget Sound to Lake Washington, a distance of about 6.5 miles. Long in the planning stage, heightened interest in the project since 1951 and vigorous action by city and county planning bodies may result in a bond-issue referendum being brought before the voters this year. The toll facility will serve the tremendous Northgate Shopping Center, and will be flanked by several new parks and recreational areas.

Thoughts at Random—Plans are already well under way for the second annual National Highway Conference of County Engineers and Officials, which will be held September 13-15 in Columbus, Ohio, under the sponsorship of the County and Local Roads Division of the American Road Builders' Association. Test traffic on the WASHO test road in Idaho has been stopped; reports concerning the findings of the two-year test are not expected for several months. Although it's a little late, the Irish over the country will be glad to know that marchers in the St. Patrick's Day parade on Fifth Avenue were again guided by a Kelly green traffic stripe. The first section of the New York State Thruway—110 miles, from a point south of Rochester to Verona, Oneida County—will be opened to traffic on June 24. Do you see the *Traffic Quarterly*, published by the Eno Foundation, Saugatuck, Connecticut? Write and see if they'll put you on the mailing list. If you're interested, I have accumulated a fairly comprehensive bibliography of modern references in airport planning and design; I'll send it, if you request it.

People—Governor Dan Thornton of Colorado heads the Action Committee of the President's Highway Safety Conference, which set a goal of cutting the fatality rate in highway accidents by 40 percent during 1954. The "Tramp Editor", Roy Kerr of the *Dixie Contractor*, tells us that Dick Smith, BPR district engineer for Florida, has been transferred to Atlanta as Construction Engineer, and K. F. Shippey of the Atlanta office has been named district engineer for South Carolina. They tell us, too, that "Doc" Symons, our fellow columnist here at Public Works, is joining the Research Division of NYU's College of Engineering.

PUBLIC WORKS DIGESTS

THE SEWERAGE AND REFUSE DIGEST

Progress in German Treatment

The sewage from only 40% of the population of the Bundesrepublik of Germany receives treatment. Some recent improvements in the existing plants are described by the author. To determine actual detention periods in settling tanks, radioactive isotopes are used instead of coloring matter or salt. To reduce the kinetic energy of sewage entering settling tanks in the Emscher District, two concentric slotted cylinders are placed in the center of the tank; tests showing that this increases the actual detention period from 10% of the theoretical without them, to 53% with them. Where a filter is covered to reduce the fly and odor nuisances a forced-draft fan is provided in the roof with a capacity equivalent to 30 times the volume of sewage treated, forcing air downward through the filter. Methods of heating sludge digestion tanks include injecting steam into the sludge is the digester; pumping the sludge through a heat exchanger outside the tank; and heating the digester by means of a double-walled cylinder in the center of the digester to which hot water is supplied from a boiler. In the last method, two concentric steel cylinders are used with a 2-in. annular space between them through which hot water circulates, the sludge passing upward through the inner cylinder. Where the polluted Emscher river flows into the Rhine, the former is tested continuously to prevent unauthorized pollution of the Rhine. Emscher water is pumped continuously into a tank, where instruments record the pH, turbidity and dissolved oxygen. The water then flows to two tanks containing also fresh tap water in proportions to give a concentration of Amscher water at least 10 times as great as the dilution in the Rhine. These two tanks are fish aquariums and serve to check the toxicity of the Emscher water.

"Sewage Treatment Progress in Germany." By H. Rohde, Chf. Engr. of Sew. Treat., Ruhr Dist. *Water & Sewage Works*, April.

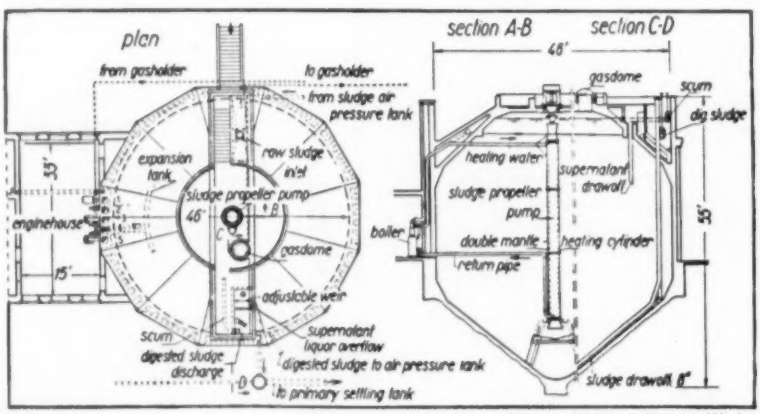
English Report On Synthetic Detergents

A Committee on Synthetic Detergents was appointed in May 1953 by the English Minister of Housing and presented an interim report in March 1954. It considered that the use of detergents presented little danger to the hands of users or other health hazards; was not definitely corrosive to plumbing or utensils; and the most serious problem was foaming at sewage treatment plants and in rivers receiving sewage effluents, especially where the plants employed aeration processes. Methods tried for suppressing foam are either troublesome or expensive or both. Considering the effects of detergents on sewage treatment generally, there are some plants where preliminary treatment includes "cracking" with sulfuric acid, where the use of synthetic detergents has been found detrimental. Most of the types of detergents in common use are not easily removed by sewage treatment processes, perhaps half of the active matter passes right through the sewage works. Further investigation will include a visit to the United States of two members of the committee.

"Synthetic Detergents." *The Surveyor*, April 3.

Treating Institutional Sewage and Ground Garbage

The Dixon, Illinois State School for the mentally retarded treats the sewage and ground garbage combined in a conventional plant which includes a screen, clarifier, trickling filter, and a single-stage digester with floating cover and external heat exchanger, and uncovered sludge drying beds. Garbage grinders were installed in 1953, and it was found necessary to increase the sludge-pumping facilities and to dispose on farm lands excess sludge beyond the capacities of the beds. A study of the plant was made in October, 1953, which is described in this article in considerable detail. In some respects the conditions differed from those in municipal



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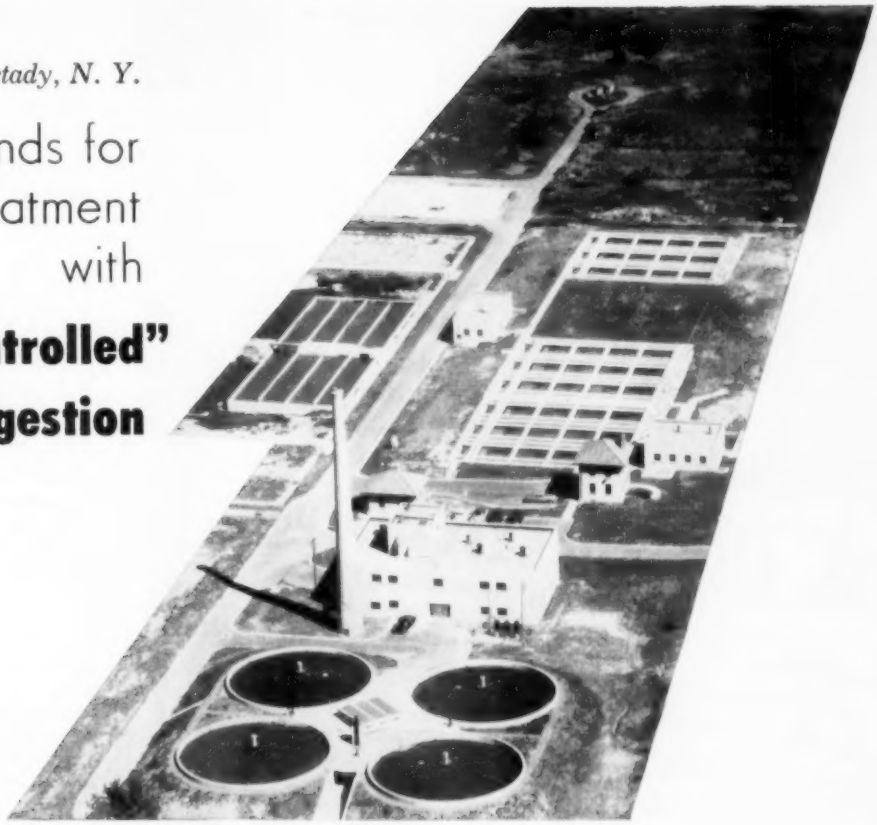


Home of the kitchen "Disposall", Schenectady recently added to its sewage treatment facilities and chose PFT equipment for modern "controlled" digestion!

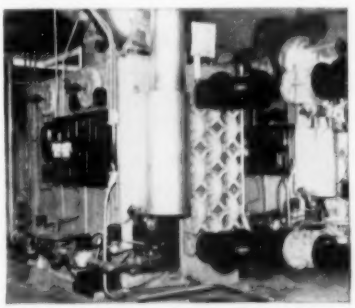
Four 65 foot digestors were added, each equipped with a PFT *Floating Cover* for positive scum submergence and flexible capacity (covers simply rise or lower with additions and withdrawals). With Floating Covers, nuisance from odors and flies is eliminated—explosion hazards are reduced because gas collected under the cover can escape only at the desired point.

Two PFT *Heater and Heat Exchanger* Units—both fired by gas *or* oil—maintain optimum temperatures. Oil firing was used, for example, until sufficient gas was produced by the digestion process to satisfy fuel requirements. Schenectady's two heaters also provide heat for building radiation and pre-heating of sludge.

For automatic, continuous withdrawal of the best digestor liquor, five PFT *Supernatant Selectors* are installed (one fixed, four removable) along with four PFT *Gauge*, *Sight Glass* and *Sampler* Units. Explosion hazards are further reduced by PFT *Gas Safety Equipment.*

Design and reconstruction of the plant was made under the supervision of Morris Cohn, Schenectady's Commissioner of Public Works. Complete information on all or any part of Schenectady's equipment is yours upon request.

Design of plant by / Havens & Emerson, New York and Cleveland



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plants; the sewage is fresher and varies greatly in volume from hour to hour; the amount of garbage per capita was greater, averaging 0.91 lb. per capita per day, fluid in consistency. The combined sewage and garbage averaged 400 to 590 ppm BOD, and 83° F temperature. Orifices in the distributor arms had to be cleaned every 2 to 4 hr. to remove orange peels, tongue depressors and similar solids. Sludge retention time in the digester was 27 to 34 days. The bottom sludge was about 5° cooler than the return recirculating liquor. The digester was evidently overloaded, and a thorough study was made of the capacity needed. Different methods of calculating indicated the capacity needed to be between 8.5 and 12.6 cu. ft. per capita; it was considered obvious that the capacity should be based on fundamental solids study rather than on the use of BOD equivalent. This method of disposing of institutional garbage shows great promise of success, but adequate planning and preparation for it is necessary.

"An Institutional Sewage Treatment Plant Handles Ground Garbage." By C. W. Klassen and L. D. Hudson, State Dept. of Pub. Health, and R. G. Thomas, San. Eng'r Lee County Health Dept. *PUBLIC WORKS*, May.

The Future of Industrial Wastes Treatment

Research projects on industrial wastes treatment were, in 1953, under way at 38 institutions in the United States, most of them educational ones. Of these projects, 6 dealt with textile wastes, 6 with cannery, 4 each with pickle liquor and pulp and paper; 3 each with phenolic and dairy wastes; 2 with metal plating, cyanide and detergents; and one each of 6 other wastes. In 1952, nearly 3 billion dollars were spent in research. The *usage* of some synthetic matters tends to present a more important problem than wastes from their *manufacture;* insecticides washed from farm lands are a threat to fish and may pass through modern water purification plants. Industry is endeavoring to meet the problem presented by the enormously increasing volumes of wastes it produces in various ways. The author lists under treatment trends: treatment at source, re-use, anaerobic digestion, high-rate filters, activated sludge, chemical treatment, dairy waste aeration, spray irrigation, and mixing with domestic sewage. Research is needed in formulating new parameters, in analytical procedures, toxicological studies, ion exchange, biological study of high-rate filtration, and tastes and odors.

"The Future of Industrial Wastes Treatment." By Hayse H. Black, U.S.P.H.S. *Sewage and Industrial Wastes*, March.

Discharging Effluents into Lakes

In maintaining lakes suitable for sources of water supply, as well as attractive for recreation, and free of nuisance conditions, a serious problem is the prevention of prolific algal blooms, especially their effect on determining what is a safe loading of sewage effluents. Sewage contains all the ingredients needed to support algae. The mineralizing actions of treatment plants do not remove these ingredients but release the fertilizing matters in inorganic forms. Various conditions—climate; size, shape and depth of the lake; and balance between plant and animal forms in the lake—determine how much fertilizing materials may be allowed to enter a given lake

without developing nuisance conditions. Such materials are contributed by run-off of rain from the surface, and by decomposition of bottom deposits. The amount of fertilizing matters that can safely be contributed by sewage is the difference between the total amount that the lake can assimilate and that derived from these existing sources. The author discusses how such a calculation can be made. In a discussion, Harold B. Gotaas suggests that the sewage nutrients can readily be removed from a sewage effluent before discharging it into a lake by passing it through ponds in which algae are grown and removing the algae before emptying it into the lake. The algae removed would be valuable as stock feed.

"Factors Involved in Disposal of Sewage Effluents to Lakes." By Clair N. Sawyer, Prof. of San. Chemistry, M. I. T. *Sewage and Industrial Wastes*, March.

Decreasing Sewer Stoppages

Sewer stoppages in Princeton, N. J. have been very materially reduced in number by taking various measures, including enforcement of ordinances controlling the laying and inspecting of laterals and house connections. Where stoppages have occurred repeatedly, the pipe has been replaced with iron or cement-asbestos, or bypasses installed. Grease traps have been ordered installed and maintained; copper sulfate is used to prevent root stoppages; improved sewer-cleaning apparatus is used.

"Why Sewer Stoppages Have Decreased." By I. Russell Riker, Boro Engr. *PUBLIC WORKS*, May.

Gas Deflection Baffle in Septic Tanks

A new idea in septic tank construction has been devised by R. E. Hamilton, research graduate assistant at the Univ. of Illinois, called the "Hamilton baffle." The tank is constructed with the ordinary inlet and outlet baffles, but the outlet baffle is so placed that the space between it and the outlet wall is sufficient to contain a volume of sewage equivalent to the maximum instantaneous discharge into the tank expected to occur under ordinary conditions—estimated at 12 to 15 gallons. Thus the entrance into the tank of this quantity will force out of the tank only sewage which has been standing in this space, and has been clarified by sedimentation following the previous discharge

into the tank. To permit maximum clarification of this sewage so retained beyond the baffle, another baffle is placed below it which deflects the rising gas bubbles from this retained sewage; similar to the construction of the slot in an Imhoff tank. Six months' operation of ordinary one-compartment and three-compartment septic tanks, a tank with a Hamilton baffle, and an Imhoff tank showed a carry-over of settleable solids into the effluent of the Imhoff tank and of the one with the Hamilton baffle not more than one-fifth of that from a tank without the baffle. The baffle also reduced slightly the total suspended solids, turbidity and BOD.

"Improving Septic Tank Efficiency With a Gas-Deflection Baffle." By E. Robert Baumann, research associate, and Harold E. Babbitt, Prof. of San. Eng. Univ. of Illinois *Water & Sewage Works*, March.

Designing Screen Chambers

The capacity of a screen is a function of the size of opening, the area submerged, the velocity of flow through the screen and the approach and exit channels, the angle of setting, the permissible loss of head through the screen, and the method and frequency of cleaning. Influent and effluent channels should be designed to produce a uniform distribution of flow at the proper velocity. Screen chambers should not be located in deep pits unless it is unavoidable. Various state health departments and boards consider screens desirable at all sewage treatment works and specify screen sizes, velocity of flow, slope of screen, etc. Several details of construction are given, and an illustrative problem.

"Sewage Screen Chamber Design." By Joseph C. Federick, N. Y. State Dept. of Pub. Wks. *Water & Sewage Works*, April.

Treatment Plant Effluent for River Control

The Ottawa river flows through Lima, Ohio with a fall of 11 ft. in the river bed in a distance of 13,000 ft. At times of low flow the river bed is exposed and becomes an eyesore. To prevent this, five dams 5 or 6 ft. high have been built at intervals, to maintain a minimum water depth of about 3 ft. To maintain this depth at times of minimum river flow, effluent from the sewage plant will be pumped to the upper pool at the rate of about 8 mgd. The biologically treated effluent will be chlorinated and be as good as, and probably better than, the river water.

"Sewage Can Make a River More Attractive." By E. E. Smith, Director of Utilities. *American City*, April.

Manholes Checked For Dangerous Gases

In 1951 San Francisco, Calif. organized a gas survey crew to examine all sewer manholes for the presence of dangerous gases. During the past fiscal year, 7,154 manholes were tested; 871 contained explosive gases in concentrations not considered dangerous and 101 contained dangerous concentrations. Carbon monoxide in concentrations below 0.12% was found in 79 manholes; a deficiency of oxygen in 14 manholes. Only one showed a slight trace of hydrogen sulfide. With the detection of toxic or explosive gas, action is taken immediately to find the cause or source and provide proper ventilation. In testing a manhole, a sampling hose is lowered 6 ft. through a ventilation hole in the manhole cover and a test for CO is made with a portable CO indicator, followed by tests for H_2S, explosive gases and oxygen deficiency. Then the hose is raised to within a foot of the cover and a test made for CO and explosive gases. Then the cover is removed and the manhole inspected for clogged pipes, sludge, dirt, etc. If the explosive gas has an odor of a chemical vapor, side sewers in the vicinity are tested with the explosimeter to locate the source of the chemical. If there is no chemical or natural gas odor, water meter boxes in the vicinity are tested, since if gas is leaking from gas mains, it usually accumulates in them. The instruments used in conducting the tests are: (1) hydrogen sulphide detector; (2) colorimetric carbon monoxide tester; (3) carbon monoxide indicator; (4) explosimeter; (5) Koehler flame safety lamp; (6) a sampling line.

"Manholes Checked for Toxic and Explosive Gases." *PUBLIC WORKS*, May.

Preventive Maintenance At Treatment Plants

The author defines preventive maintenance as essentially a scheduled maintenance program for keeping the equipment and structures in a good state of repair, correcting faults in the early stages. The essential requirements are: 1. Training of all operators or maintenance per-

sonnel in proper operating procedures and preventive maintenance practices. 2. Systematic and periodic inspection and servicing by skilled personnel. 3. Assignment of specific maintenance responsibilities to operating personnel. 4. Supervision of the program. The author describes what each of these involves, and suggests forms for record cards.

"Preventive Maintenance." By F. A. Sanders, Lt. Col., USAF Inst. of Technology. *Sewage and Industrial Wastes*, March.

Split Activated Sludge Plant

The cities of Benton Harbor and St. Joseph, Mich., have built a joint sewage treatment plant designed to remove 65% of the BOD and 75% of the suspended solids from 8 mgd, estimated sewage from the population in 1975. The plant utilizes the "split activated sludge process of Darwin W. Townsend. This process involves primary treatment for the entire flow, and conventional activated sludge treatment for a portion of the primary effluent, the effluent from which is mixed with the remaining portion of the primary effluent; the portion receiving secondary treatment being such a percentage of the whole that the BOD and SS of the combined final effluent shall have any desired values between those of the primary effluent and the minimum obtainable by activated sludge treatment of the whole. For this plant it is intended to obtain 40% removal of BOD and 55% removal of suspended solids from half of the sewage in the primary tank, while the other half receives 95% removal of each by combined primary and secondary treatment; giving overall removal of 67.5% of BOD and 75% of SS.

The sewage after passing through screens, grit remover and comminutors, is pre-aerated in tanks providing 15 min. detention with 0.1 cu. ft. of air per gal. through diffuser tubes. This is followed by 2 hr. detention in primary sedimentation tanks. A single-pass aeration tank is provided with piping arranged to add return activated sludge, to divert digester liquor to the tank, and to recirculate the tank contents. Intensive aeration is provided. Three 2-pass aeration tanks provide 6.65 hr. detention time for a flow of 4.0 mgd (half the total flow) plus 25% return sludge. Secondary sedimentation tanks are provided with nozzle-type sludge collectors. Chlorination facilities provide for 20

ppm chlorine. Three digesters with floating covers and external-type sludge heaters provide 45 cu. ft. capacity per pound of volatile solids during the canning season. Vacuum filters provide one sq. ft. of filter area per 5 lb. of dry solids per hour based on 35-hour weekly operation. A gas storage sphere 40 ft. in diameter holds gas compressed to 40 lb. per sq. in. The total construction cost was $1,882,812.53.

"Split Activated Sludge Plant Built by Twin Cities." By Herbert H. Ley. *Wastes Engineering*, April.

Oxygen Consumption In the BOD Test

The summary of current opinion is that the BOD reaction does not follow the monomolecular law, and therefore it is not possible to calculate *L* (total demand or load) from oxygen uptake data. There has been some reluctance to accept this viewpoint because experimental procedures for rigorous tests have not been worked out. The authors have been able to subject the formula to a rigorous test, which they describe; and they describe a method for the chemical determination of total oxidizable carbon, proposed for research purposes in connection with large projects. However, "at present the 5-day BOD appears to be the most suitable empirical test for estimating the strength of wastes. The vast amount of data on this test collected over half a century cannot be ignored. No present theory, however, justifies the calculation of total load from 5-day BOD determinations. Empirical factors in limited areas may be developed when used in connection with chemical determination of total oxidizable carbon."

"Bacteriological Explanation of Rate of Oxygen Consumption in the BOD Test." By A. M. Buswell, H. F. Mueller, and I. Van Meter, Illinois State Water Survey. *Sewage and Industrial Wastes*, March.

Effect of Waves In Effluent Disposal

When a sewage effluent is discharged into a large body of water, there should be adequate mixing of it with the water. The chief factors in effecting this are the jet discharge into the water; thermal convection and diffusion due to temperature difference between the sewage and the receiving water; and the oscillating action of both ocean swell and wind waves. The size, shape and movement of the sewage field are affected by the jet discharge size and shape; translation by wind action on the water surface; mass transport which accompanies wave motion; local currents; and density difference between the effluent and the receiving water. This article discusses the character of wind-generated waves, which are chief agents in the mixing. Nearly all of this mixing occurs in a surface layer of water whose depth is approximately one wave height. Wind blowing over a sewage field will cause a surface layer of the field to be translated at an appreciable rate in the direction of the wind. Wave mass transport also translates a sewage field in the direction of wave travel, but this movement is of second order importance.

"Waves as a Factor in Effluent Disposal." By E. K. Rice, Inst. of Eng. Research, and J. W. Johnson, Univ. of Calif. *Water & Sewage Works*, April.

Other Articles

"Sewer Maintenance in Los Angeles" covering 450 sq. mi., 4,000 miles of

sewer, 96,000 manholes, etc. By Guy Browning Arthur. PUBLIC WORKS, May.

"Steel Production Wastes at the Fairless Works, Disposal". Details of treatment of acid, alkaline, oil and miscellaneous wastes. By G. A. Howell, Asst. Chief Engr. U. S. Steel Corp. Sewage and Industrial Wastes, March.

High-rate trickling filters treat a combined waste, 79% of the BOD load of which is industrial. "High-Rate Filters Treat Mixed Wastes at Sharp & Dohme." Sewage and Industrial Wastes, March.

"Treating Industrial Wastes: Calcium Chloride Coagulates." By Joseph A. McCarthy; and "Trickling Filters Treat Flax Wastes." By Warren H. Oldaker; both papers by members of the Lawrence Experiment Station. PUBLIC WORKS, May.

"Supplemental Irrigation with Treated Sewage." Why, where, when and how to use it. By Henry J. Hunt. Sewage and Industrial Wastes, March.

"Philadelphia Northeast, Early Operating Experiences," a modified activated sludge plant which went into operation April 6, 1951. By Ralph A. Hoot, Chf. Sew. Treat. Section. Sewage and Industrial Wastes, March.

"Trickling Filter Operation." By Don E. Bloodgood, Prof. of San. Eng., Purdue Univ. Water & Sewage Works, April.

"Garbage Collection" in the State of Washington, Costs and Practices. Data obtained by the University of Washington from 191 cities. PUBLIC WORKS, May.

"Process Engineering in Stream Pollution Abatement" can reduce the volume of wastes and recover chemical values economically. By A. N. Heller and M. E. Wenger, Allied Chemical & Dye Corp. Sewage and Industrial Wastes, February.

"Treating Optical Rouge Wastes by Chemical Coagulation." By Joseph A. McCarthy, Lawrence Experiment Station. Wastes Engineering, March.

Vitamin B-12 from Milorganite. "Pilot Plant Makes Vitamin B-12 From Processed Sewage Sludge." Wastes Engineering, March.

"Refuse Disposal Plant, Port Glasgow's New." Contractors Record (England), March 10.

"Batch-Truck Dumping Delays on Paving Jobs." May exceed an hour a a day. Roads & Streets, March.

"Combing Aggregates, Graphical Method." By J. Rogers Martin, Hot Mix Asphaltic Concrete Ass'n. Roads & Streets, March.

"Coefficient of Friction of Road Surfaces." By J. H. H. Wilkes, County Surveyor of Somerset, England. The Surveyor (England), Feb. 17.

Television as public relations medium. "Want Public to Back Your Road Aims? Try Television." By William F. Steuber, Wisconsin H'way Com'n. Better Roads, February.

Engineering and Inspection

(*Continued from page* 125)

As soon as construction starts, supervision and inspection will become important. There may be shop drawings submitted by the contractor or a sub-contractor to be approved. The contractor will submit a list of the kind and type of materials he proposes to use and it will be necessary for the engineer to accept or reject these items based upon the requirements of the specifications. Certain methods of construction may require prior approval. A construction schedule must be prepared by the contractor and approved by the engineer.

The approved schedule of construction will serve as a guide for many activities. Utilities may plan the sequence of their work. The material suppliers can schedule their deliveries. Detours can be planned. Consideration may be given to any special events planned in the city and ways may be devised to accelerate the progress of the improvement by working nights and/or weekends during certain times to lessen the inconveniences on very important streets and special routes.

Inspection and engineering control of the work in the field is usually provided by a project engineer under whom there may be one or more resident engineers over each phase of the work. Or the project engineer is dispensed with and one resident engineer supervise all field engineering and inspection.

Inspection may be defined as the skilled and informed observation of construction to insure compliance with the plans and specifications. The required number of inspection personnel is determined by the scope of the work and may vary during the project. There are usually one or more inspectors following the work on the street and one or more at the plant where material is being mixed or prepared for use on the street. Most contractors are interested in doing a good job and, believe it or not, any engineer will tell you that he would much prefer having a contractor on a job who is making money rather than one who is losing or barely breaking even. As a rule, the contractor and inspectors work as a team with the inspectors assisting the contractor in every way they can to secure a good job at a minimum cost.

Field surveys to provide controls, such as line and grade, are furnished by one or more field parties.

Testing of materials and products is an important phase of the construction. Testing services are usually provided by a commercial testing laboratory. This can be handled best, in my opinion, by a separate contract between the city and the testing laboratory. The engineer will outline the testing required and will assist the city in inviting proposals and selecting the testing laboratory. The testing laboratory usually works under the direction of the engineer, submitting their reports directly to him. The practice of having the contractor pay for the testing should be discouraged. The practice of having the contractor furnish certified mill tests on certain items is acceptable. Testing is usually confined to laboratory work to determine that materials meet specified standards. At times, some tests may be required in the field. A judicious amount of testing is money well spent.

Construction contracts normally provide for partial payments to the contractor as the work progresses. These payments are usually made monthly. It is the duty of the engineer to prepare or approve the estimate of the amount due. The contractor is usually paid 90 per-

cent of the work performed to the date of the estimate.

Another duty of the engineer is that of coordinating the activities of different contractors, or the work of utilities and contractors. He will see that the construction proceeds according to schedule. He may give the contractor an extension of time on the contract if the contractor is delayed through no fault of his own. He will see that traffic and the public is given every consideration consistent with good construction practice.

At the completion of the work, the engineer will make a final inspection and will supervise any tests of acceptance which may be required. He will require the work to be cleaned up and turned over to the city in a complete and acceptable manner.

The advantages of good engineering and inspection may be summed up by saying that good engineering and inspection insures the city that it will secure a program that fits its needs with its ability to pay. The program will be well balanced, and take into consideration the materials available, the construction market, and the needs of the community. The work will be planned and executed in such a manner as to relieve the governing body of the responsibility of supervising work and selecting materials and methods in a highly specialized technical field without competent advance and guidance. In short, good engineering and inspection is an assurance that the community is getting its full money's worth on the work being done.

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Vehicle Size & Weight and Toll Road Studies Authorized

Included in the new Federal-aid law is a provision authorizing the Secretary of Commerce to include in a highway research program studies of economic geometrics, structures and desirable weight and size standards for vehicles using the public highways, and the feasibility of uniformity in State regulations with respect to such standards.

Authority for the Secretary of Commerce to make a comprehensive study of all phases of highway financing, including a study of the cost of completing the several systems of highways in the several states, and of the progress and feasibility of toll roads with particular attention to the possible effect of such toll roads upon the Federal-Aid Highway Program is also provided.

PUBLIC WORKS DIGESTS

THE WATER WORKS DIGEST

Theoretical Principles Of Aeration of Water

This comprehensive discussion of the principles involved, chiefly in the addition and removal of oxygen and carbon dioxide, includes the fundamental concepts, including equilibrium, gas solubility, diffusion, and the properties of a gas-liquid interface. Aeration equations are developed, and the effects of temperature, agitation, film thickness, gas partial pressure, and depth of basin on gas exchange rates are discussed. This article is quite technical and occupies 24 pages of the Journal.

"Theoretical Principles of Aeration." By Paul D. Haney, San. Engr. Director, USPHS. *Journal, AWW Ass'n*, April.

Houston's New Surface Water Supply

Houston, Texas until recently obtained all of its water supply from underground beds of sand hundreds of feet thick. The supply seemed to be limitless, but recent rapid increase in the draft upon it resulted in a considerable drop in the pumping level and resulting increase in cost of raw water. In March 1952 construction was begun on a project for obtaining water from the San Jacinto river through 14 miles of canal, and filtering it in a plant with a capacity of 80 mgd as a peak demand rate. The works, which were completed early in 1954, afford rapid mixing for 1 min., flocculation for 45 min., settling for 3½ hr., and filtration at 3.2 gpm per sq. ft. Provision is made for prechlorination at 4 ppm, coagulation with 2.2 gpg of aluminum sulfate, and stabilization with 9.75 gpg of lime. The plant contains several unusual features. The operating controls are not all centralized at one point, but at four points, each close to the actual operation—laboratory, chemical building, filter gallery, and distribution pumping station. Rubber-lined butterfly valves are used for all low-pressure service, with a substantial reduction in space and a cash saving of $124,000. The raw-water pumps, rapid-mix drives and finished-water transfer pumps are unhoused, as are the storage bins for coagulant and lime. Colored "graphic panels" are placed over the central instrument panel and the plant control panel, with each instrument color-coded. Activated carbon in bulk is stored and handled as a water slurry, which is measured by "Rotodip" feeders. The total cost of the plant was $4,900,000, of which $385,000 was for separate raw-water pumping equipment for industrial water.

"Surface Water for Houston." By Nat P. Turner. *PUBLIC WORKS*, May.

Disinfecting New Mains

The placing of dry hypochlorite powder in the bottom of each pipe as it is laid is a far from satisfactory method of sterilizing new mains, for the main cannot be flushed prior to sterilization, and most of the disinfectant is washed to the far end. The California Water Service Co. has used on several hundred jobs during the past two years a variation of this procedure. The disinfectant, in the form of HTH, is fastened to the top of the pipe interior, where it dissolves slowly after the pipe has been filled with water; several hours being required to dissolve the tablets. Hot tar is used for fastening the tablets to the pipe.

"Convenient and Effective Method for the Disinfection of New Mains." By J. R. Rossum, San. Engr. *Water & Sewage Works*, April.

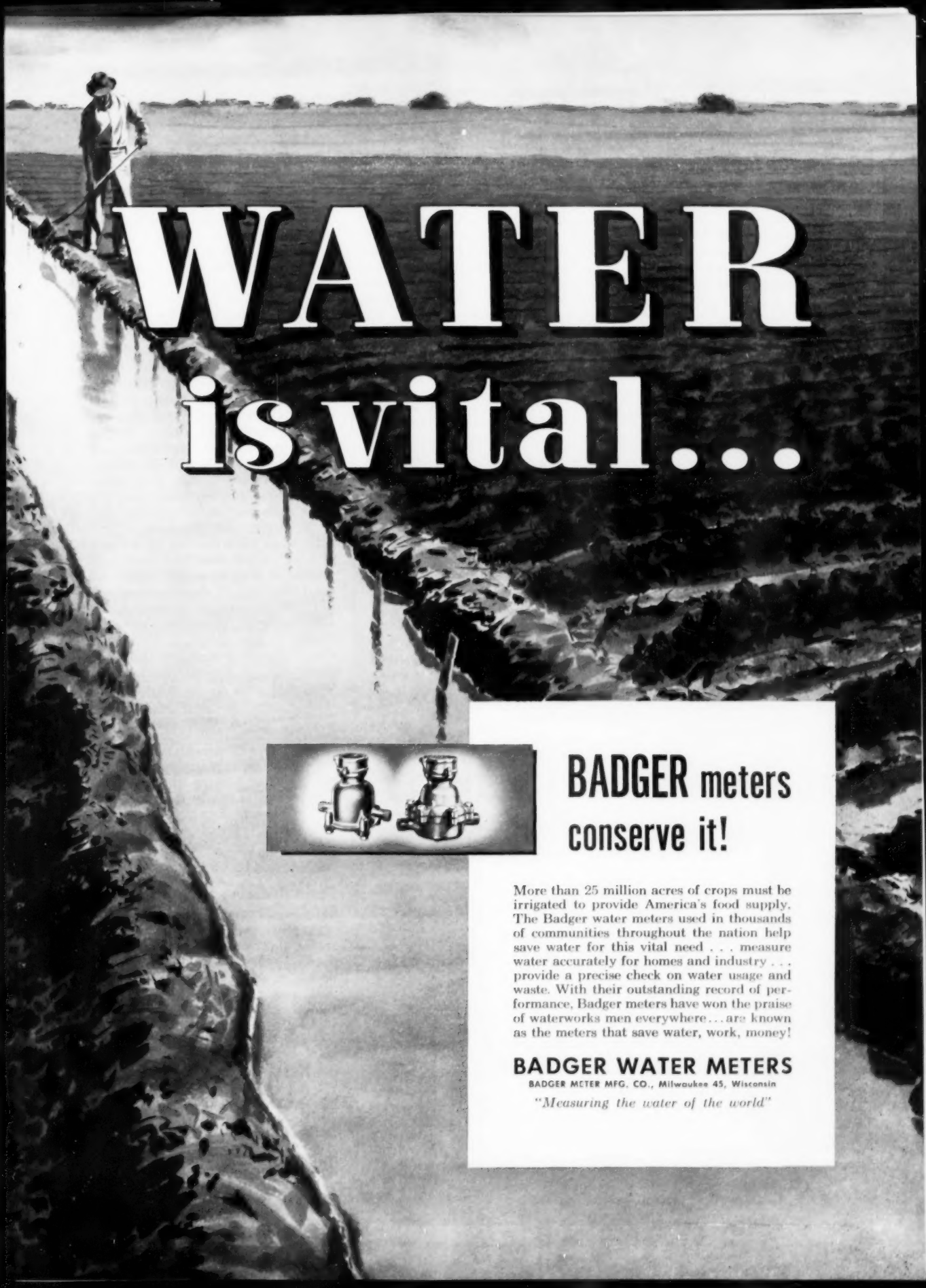
Selecting Main Line Meters

The selection of a main-line meter should not be based on price alone, but consideration should be given to

"Pie Pan" Applies Lubricant to Ring-Tite Pipe Joints

R. C. O'REILLY,
City Manager, Indio, Calif.

AN ingenious device for applying lubricant to Johns-Manville Ring-Tite pipe has been developed by the Indio, Calif., Water Department. When laying its first pipe of this kind, the Department noted that the greatest time loss occurred in lubricating the joints. The old method of applying lubricant with a padded glove was slow, so the Department developed its own method. An applicator was devised that looks like a pie tin with a handle on the bottom. The inside edge is felt-lined and is designed to fit the surfaces of the pipe. The lubricant is applied to the felt lining and is then transferred to the pipe when the pan is pressed against the end of the pipe. One application of lubricant to the pan will handle at least two joints. Applicators are made for all the small diameters of pipe.



BADGER meters conserve it!

More than 25 million acres of crops must be irrigated to provide America's food supply. The Badger water meters used in thousands of communities throughout the nation help save water for this vital need . . . measure water accurately for homes and industry . . . provide a precise check on water usage and waste. With their outstanding record of performance, Badger meters have won the praise of waterworks men everywhere... are known as the meters that save water, work, money!

BADGER WATER METERS

BADGER METER MFG. CO., Milwaukee 45, Wisconsin

"Measuring the water of the world"

reputation of the meter; anticipated life and accuracy; materials; workmanship, and probable cost of maintenance. Most important is the non-recoverable loss of head caused by the meter. This article deals with the last factor, comparing the head losses in the standard Venturi tube, the short-form Venturi tube, the flow nozzle and the orifice, and calculating the dollar values of the head losses caused by the several types.

"Selection of Main Line Meters Simplified by Use of Charts." By John C. Thoresen, Builders-Providence, Inc. *Water & Sewage Works*, April.

Coliform Differentiation By Membrane Filters

A field study of water examination by both the membrane filter and the MPN procedures has been made by bacteriologists of the USPHS, using samples of water from sources known to contain several intermediate types of coliform organisms, as well as typical *Esch. coli* and *Aer. aerogenes*. From the data obtained by methods described, "it is evident that the great majority of coliform organisms growing on the membrane filter develop a characteristic "metallic" yellowish surface luster and subsurface color. It is equally evident that the great majority of colonies that do not develop the sheen and color are not coliform organisms as defined by *Standard Methods*.

"Type Differentiation of Coliform Oraganisms with Membrane Filter Technique." By Harold L. Jeter, Edwin E. Geldreich and Harold F. Clark, bacteriologists, USPHS. *Journal, AWW Ass'n*, April.

Cathodic Protection For Steel Filter Piping

When Toledo, Ohio, changed its source of supply from the Maumee river to Lake Erie, there was a great increase of corrosion and tuberculation in the pipe system, and especially in the steel pipes within the filtration plant and the filter surface-wash equipment. The steel piping and headers of the filter wash were thoroughly cleaned and high-grade anti-corrosive paint applied at 4-yr. intervals. This lessened the rate of deterioration but did not prevent it altogether. In 1951 cathodic protection was installed in one of the 20 filter beds and corrosion ceased. In 1953 this protection, of the sacrificial anode type, was installed in all the other beds, at a cost less than the expenditure for a single cleaning and painting of the equipment. Periodic inspections, adjustments, and maintenance of all installations are provided by the Electro Rust Proofing Corp. under a yearly contract.

"The Toledo Story of Corrosion Prevention." By George J. Van Dorp, Com'r of Water. *American City*, April.

Slime Reduces Flow in Concrete Pipe

Hartford, Conn., brings a very soft surface water seven miles to the purification plant through two mains, a 42-in. cement-lined cast iron and a 32-inch concrete. In 1942 a test of the latter showed a William & Hazen coefficient of 150, and the former a coefficient of 137 in 1945. A test made in 1947 showed that the coefficients had dropped to 114 and 120 respectively. By December 1952 the coefficients had dropped to 111 and 106. The lines were unwatered, one at a time, and an inspection was made by crawling through the whole length. No defects were found, but the walls of both pipes were covered with a slime, 1/32 to 1/16 in. thick. An analysis

of this slime showed 30 to 47% manganese, 8 to 20% iron, 20% organic matter. The water as it entered the pipes contained only 0.008 ppm of manganese, but that leaving contained only half this amount, indicating that some manganese was being added to the slime.

A mile-long section of one line was dosed with 50 ppm of chlorine for 11 days and then flushed, the effluent being highly colored and turbid. The coefficient increased from 111 before flushing to 133 after it, but two years later it had fallen to 106. As there is sufficient capacity in the mains, even with the lowered coefficients, nothing is being done toward remedying the condition, the only means of effecting which appears to be a continuous program of repeated chlorination.

"Deterioration of the Hydraulic Capacity of Pipelines." By Alexander J. Minkus, Engr. of Water Purif. *Journal, N. E. W. W. Ass'n*, March.

Action of Ozone on Water Bacteria

The production of ozone by means of equipment employing closed ozone generators costs too much to make it attractive for treating public water supplies. In recent years open generators have been developed which may prove economical and efficient. Tests have been made by the Mass. Agricultural Experiment Sta., using an open brush-type ozone generator (furnished by the Norwood Filtration Co.), which showed that, with bacterial suspensions containing little organic matter, ozone was strikingly effective in killing the bacteria. But an ozone residual of 2 ppm applied for at least 5 minutes would be required to treat satisfactorily raw water of low organic content.

"Action of Ozone on Water-Borne Bacteria." By J. M. Dickerman, A. O. Castraberti and J. E. Fuller. *Journal, N. E. W. W. Ass'n*, March.

Asphyxiation in A Water Works Manhole

In Minneapolis, in a valve manhole nine feet deep in a street in a low, swampy area, a workman died of asphyxiation a few minutes after entering it, although he and others had been entering it daily for some two weeks previous. A lengthy investigation was made by the Minnesota Dept. of Health. Samples of air from the manhole were analyzed but no poisonous gases were found. Finally an analysis of soil in the bottom of the manhole led to the conclusion that oxygen depletion was caused by chemical changes brought about by organic substances in the surrounding subsoil. Four specific conclusions were reached: Manholes, particularly those in low or swampy areas, are potentially dangerous in respect to oxygen depletion. There may be substances in the subsoil other than vegetable matter which may increase the chemical oxygen demand. There is free and rapid diffusion of gases through the floor and walls of manholes. The flow of air through the manhole cover openings is ineffective under all conditions in maintaining the air within the manhole in equilibrium with the outside air.

"Unusual Case of Asphyxiation in Water Works Manhole." *Water Works Engineering*, April.

Water Revenue Bond Financing

The financing of water works improvements by water revenue bonds has become a widely accepted practice, as evidenced by the fact that cities in at least 38 states are now permitted to issue such bonds. Ap-

proximately two thirds of these states do not require a vote of the electors. Over half of the cities with authority to issue such bonds can do so for terms of 40 yr. or more; more than 2/5 reported no legal limitations on the total amount of such bonds. The interest rate on water revenue bonds during the past 20 yr. has varied from 1.67% to 4.0%. The interest rate on water revenue bonds has been 0-1.5% higher than on similar-term general-obligation bonds.

"Survey of Water Revenue Bond Financing." By D. L. Erickson, City Engr. of Lincoln, Neb. *Journal, AWW Ass'n*, April.

Pollution Control On a Large Watershed

Jersey City, N. J. obtains its water supply from a watershed with an area of 118 sq. mi. Several towns are located on this area, with a total population of about 30,000. The sewage of all of these and wastes from industries are collected by 13.7 mi. of trunk sewer owned by Jersey City and treated in a plant which it operates, so that no pollution originating on the watershed drains into any tributary of the city's water supply. Samples are taken for analysis regularly at the water plant intake and at the inlet to the reservoir. Reforestation is carried on for a width of 7 mi. around this reservoir, and algae and aquatic growths are removed from the shores during low-water periods. A total of 57 persons are assigned to the watershed protection program.

"Pollution Control on the Jersey City Watershed." By Robert J. Budrick, Prin. San. Engr. *Journal, AWW Ass'n*, April.

Other Articles

"Design, Construction and Operation, Public Health Factors in Water Plant." A comprehensive text, covering the development of a system from the selection of a source of supply and site for the plant, through planning the treatment methods and plant details, construction and operation. By Dwight F. Metzler, Chf. Engr. & Dir. of San., Kansas State B'd of Health. PUBLIC WORKS, May.

An ever up-to-date water plant. "Allentown (Pa.) Stays Ahead of Increasing Water Demands." By Harry J. Krum, Supt. Water & Sewage Works, April.

"Softening Reactions, How Temperature Was Found to Affect." By Philip J. O'Connor, Supt. of Filtration, Warren, O. Water Works Engineering, April.

"Continuous Recording of Fluoride Concentration in Water, Investigation of." A field trial of equipment found to be "satisfactory, highly sensitive and useful." By Kenneth F. Knowlton, Supt. Salem & Beverly Water Supply Bd. Journal, N. E. W. W. Ass'n, March.

"Equipment Makes Better Water Department Operations." Details from Oklahoma City, Minneapolis and Omaha. PUBLIC WORKS, May.

"Hydraulic Remote Control, Experience with" in Haifa, Israel. By Walter Jacobsohn, Asst. Water Engr. Journal AWW Ass'n, April.

Lining 700 ft. of 60-in. tunnel with concrete pipe. "Events in the 1953 Operations of the Portland Water District." By Herman Burgi, Jr. Journal, Maine Water Utilities Ass'n, March.

Watertight joints in concrete structures, design, types of joints and jointing materials. "Joints in Water-Retaining Structures." By P. L. Critchell. The Surveyor, March 13.

"Mercurimetric Determination of Chloride." By Jerome F. Thomas, Asst. Research Chemist, Univ. of Calif. Journal, American Water Works Ass'n, March.

READERS DISCUSS

The Case for SEWAGE LAGOONS

An article by R. J. Ellison and R. L. Smith, "Evaluating the Use of Sewage Lagoons," appeared in our March issue. This article has evoked a number of comments, written and verbal, for and against lagoons. Here are two strong letters favoring the use of lagoons under certain conditions. These letters have been edited slightly, without changing, we believe, any statements or ideas.

W. VAN HEUVELEN,
Director,
Division of Water Pollution Control,
North Dakota State Dep't. of Health.

THE article by Messrs. Ellison and Smith in your March issue discusses sewage lagoons as used in North Dakota and concludes that their use will require higher expenditures and will increase the health hazards now associated with the disposal of sewage.

Besides the seventeen raw sewage lagoons now operating in North Dakota there are similar installations at Lemmon, Philip, and Wall, S.D.; Plentywood, Mont. and Sundance, Wyo. A small temporary lagoon receiving raw sewage from a housing development in Missouri has operated so well that the Missouri State Health Department has become interested in lagoons. They plan to study this flow-through unit for the next year to determine its place in sewage treatment in Missouri. The Oregon and Washington State Health Departments have recently approved this idea and installations will be built at Vale, Ore., and Waterville, Wash., this summer. Porter, Neb., is also planning a raw sewage lagoon with the approval of the State Health Department. Denmark and Norway have corresponded with this office describing raw sewage lagoons used in their countries. Lagoons have been approved in four Canadian provinces and we believe several are in the planning or construction process in Canada at the present time. These are a few of the lagoons and states approving their use that we have knowledge of in this office and I am sure there are others if we wished to investigate further.

Referring to the statement about disposal by evaporation, our department has never proposed sealing completely the bottom of a lagoon; in fact, a rate of seepage of ⅛ inch to ¼ inch per day is recommended. If seepage rates are much higher than ¼ inch per day some impervious material, such as clay or bentonite, should be used to slow up the seepage rates. Water to the depth of 2 to 3 feet must be maintained in the lagoon for proper operation. One successful North Dakota lagoon has a seepage rate of 0.3 in. per day with 10 acres serving a population of 1200 people.

Seepage and evaporation are not the important factors in lagoon operation. Whether the water is put into the ground and air, or discharged to a stream, is a matter to be determined for each installation. The authors state that in southern Minnesota rainfall equals evaporation, but I feel sure there is still plenty of sunshine which is really the important factor in successful lagoon operation. Sunshine is necessary for algae growth and it is this growth that makes the lagoon work.

The question of contamination of underground waters was briefly raised. In the February 1954 issue of *American Water Works Association Journal* is an article on "Underground Movement of Bacterial and Chemical Pollutants" by R. G. Butler, G. T. Orlob, and P. H. McGauhey. They report, "that bacteria will travel little more than 5 feet in moist or dry soils. This statement seems to be true for fine soils under continual submergence with sewage." The farthest distance for travel of coliform in coarse soils mentioned in their article is 232 feet. Lagoons in North Dakota with their stabilized water have coliform counts of 1000 to 4000 per 100 ml. The South Dakota State Department of Health reports similar counts from lagoons in that State. If lagoons with their stabilized water are built a proper distance from farm homes and communities, contamination of a water supply is

unlikely. We have records of hundreds of water supplies throughout North Dakota and in no case have we found contaminated water from a properly constructed and sterilized well. We realize this is due to the soil condition in North Dakota and may not hold true for all areas. Some areas with limestone, sandstone, or underground crevices may move contaminated water considerable distances.

We agree heartily that the most important aspect of sewage treatment is the control of disease. A question arises whether disease transmission from sewage is most likely from an open pond with a super-saturated oxygen content as high as 23 ppm and a coliform count of 1000 to 4000 per ml, or a river with 0 to 5 ppm oxygen and coliform counts up to 100,000 per 100 ml?

The suggestion of conventional sewage treatment before lagoons to cut down disease transmission by insects, animals, and wild fowl also raises many questions. Why place an Imhoff tank, with its odors, flies, mosquitoes and improper maintenance, adjacent to a lagoon where odors, flies, mosquitoes, etc., are not found? In water purity tests we use coliform organism counts as an indicator of contamination or presence of disease transmitting organisms. What type of sewage treatment plant other than a lagoon discharges an effluent with a coliform count under 4000 per 100 ml, unless chlorination is used? If chlorination is warranted, it is just as cheap to add it to a lagoon effluent as to a conventional treatment plant discharge.

We must admit that waterfowl are a common sight on North Dakota's sewage lagoons. The hunter in any area has no insurance that the ducks in his bag have not rested in polluted waters a few hours previous to the kill, even where there are no lagoons. We wonder if any duck traveling from Canada to Mexico does not at least once in its course rest on waters containing sewage.

The location of a lagoon is much like that of a conventional sewage treatment plant in that it should be placed away from town to avoid zoning any side of a community. We recommend both lagoons and conventional plants, if possible, be placed at least one-half mile from town. We find no $20,000 or even $10,000 homes near Imhoff tanks, or even secondary sewage treatment plants.

The statement is made, "In fact, we find that the customary treatment plant, using the best in design, has been comparable in costs to lagoons." If this is true, then Wishek, population 1200, could have built a secondary plant for $5,000; Beach, population 1200, a complete plant for $5,400, or Northwood, population 1000, a complete plant for $10,000. One item of cost that should be mentioned also is maintenance and operating cost. The lagoon requires no operator and little maintenance for proper operation. On the other hand, what percentage of small conventional plants are properly operated?

Rolling land is cited as a factor because it increases the cost. True, a flat piece of land decreases earth moving costs and is recommended, if possible. North Dakota, even though considered a prairie state, has much rolling land, especially in the western half of the State. Lagoons can be fitted to the contour of the land and costs of dirt moving decreased. Beach, for example, built two 10-acre lagoons with bottom elevation differences of 4 ft. due to the topography of the selected site.

We ask no one blindly to accept sewage lagoons as the answer to all sewage treatment problems. How-

ever, we do suggest that evaluations of sewage lagoons in North Dakota be made after several installations have been visited, inspected, and all conditions thoroughly investigated. This is a fundamental scientific practice and one upon which sound engineering is based.

I. NUSBAUM,
Water Pollution Control Engineer,
Water Pollution Control Board,
San Diego Region No. 9,
San Diego, Calif.

IN *Public Works Magazine* of December 1953 there appeared a lengthy abstract of a discussion on the use of oxidation ponds in sewage treatment by D. F. Smallhorst and B. N. Walton, Jr. of the Texas State Department of Health and Jack Myers of the University of Texas which was presented before the American Public Health Association on November 10, 1953. An excellent bibliography accompanies this article. Much additional experience has been gained in California and other parts of the Southwest demonstrating that the use of ponds for sewage treatment is a safe and valuable method.

It would be presumptuous on my part to appraise the use of ponds in states such as North Dakota, Montana or Minnesota. Information from North Dakota indicates that ponds have provided year-round safe and satisfactory means of sewage treatment. Other states east of the Mississippi have expressed an interest in the use of oxidation ponds and are permitting such installations on a limited basis to obtain some data on their use under the prevailing environmental conditions.

Incidentally, oxidation ponds treating raw or merely screened sewage are in operation in Texas and California and probably in Nevada and Arizona. Chlorination of sewage is not desirable prior to discharge into a lagoon.

The greatest deterrent to the use of oxidation ponds is the availability of site. Much more land is required than for "conventional" methods of treatment and an unreasonable prejudice exists toward the presence of ponds. Actually, it has been found that there is little or no nuisance around a properly operated plant utilizing this method of treatment.

From my own experience as a sanitary engineer I have yet to find a more satisfactory method of sewage treatment in areas where it has been applicable. Although generally lower in cost than other methods, it may equal in cost primary treatment plants of equivalent capacity. Operating costs are considerably lower. Also, it should be pointed out that with a plant containing oxidation ponds the necessity for by-passing untreated sewage is minimized. Frankly, I do not know of a more recent proven method of sewage treatment at reasonable cost.

• • •

Controlling Pedestrian Traffic

The city of Columbia, S. C., has apparently solved the problem of the control of pedestrian traffic in the business district quite effectively. Each intersection has the usual "Stop" and "Go" signals for traffic. In addition a red "Wait" on each cross walk halts the pedestrians. After the traffic has passed in each direction the traffic lights turn red and a green "Walk" appears on each cross walk sign. The intersection is then turned over entirely to the pedestrians who may cross in any way they please without fear of traffic. Traffic is then started and the cycle repeated. Pedestrians obey the signals without question now, although we understand arrests have been made and fines levied in the past.

Colored Ammonium Can Be Used on Ski Trails

The use of ammonium chloride was approved on New Hampshire Recreation Division ski slopes at Sunapee Mountain and Franconia in the vicinity of the Cannon Mountain aerial tramway in the White Mountain region. Ammonium chloride is used to hold snow between slalom gates and at heavily-used turns on regular ski trails. From the literature, from bioassays, and from assumed dilutions provided by rainfall and snow melt, it was determined that the quantities of ammonium chloride likely to be used would not endanger fish life in tributary brook trout waters. Wherever ammonium chloride is used on the ski slopes, in proposed magnitude of ½ to 2 ounces per square foot over limited areas, powdered ochre will be added as an identifying color.

• • •

Ozone

(*Continued from page 86*)

by preventing the formation of nitric acid. Don and Chisholm,[6] referring to the experiments of Warburg, state: "Calling the output of ozone in dry air under given conditions 100, the production is diminished 20 percent when the pressure of the aqueous vapour contained is equivalent to 7 centimetres (about 3 inches) of mercury."

After drying, the air is passed through an electrostatic field produced by a high-voltage current discharging between the generator electrodes. Usually a dielectric of glass or mica is placed between the electrodes. A dielectric increases the efficiency and capacity of the ozone generator. The electrostatic field converts 0.5 to 1.0 per cent of the air, by volume, into ozone.[7] A higher or lower percentage of the air may be converted into ozone but only at a sacrifice in generation efficiency.[6] Bean and Taylor[5] indicate this, as follows: "Experimental data indicate that generation efficiency is dependent on concentration of ozone produced. Efficiency of production decreases as concentration rises above one percent or decreases below 0.5 percent." Experiments[6] have shown that the starting point of ozone production occurs at a voltage of about 10,000 and that the output of ozone increases in proportion to the square of the voltage. A voltage in the neighborhood of 20,000[5,7,8] is common. Alternating current with a frequency up to 1,000 cycles per second has been used.

The mixture of ozone and air is drawn from the ozone generator through a pipe of non-oxidizable material to the mixing basin where it must be mixed intimately with the water to be treated. Mixing must be intimate because of (1) ozone's relative insolubility in water; (2) ozone's instability; and (3) the large quantity of air, relative to the quantity of ozone, in the ozone-air mixture. Mixing may be accomplished by diffusing the ozone and air through non-oxidizable perforated plates, "by allowing the gas [ozone and air] to rise through a tower filled with pumice stone down which water is trickling," [9] or by passing the mixture of ozone and air into a high-velocity jet stream of water. Mixing is followed by a contact period of 1 to 10 minutes.

Ozone may be used effectively as a disinfectant, for color removal, or for taste and odor removal. The dosage required for disinfection is in the range of 1 to 3 ppm for most waters. To insure disinfection the treated water should have an ozone residual of 0.1 ppm, as measured by the standard orthotolidine test for chlorine. Although

ozone is a good germicide, the application of ozone for disinfection, as sole objective, is more expensive than the application of chlorine for disinfection. An interesting result of using ozone for treatment of water in a 1 mgd pilot plant at Philadelphia, Pa., was the killing of bacteria resistant to chlorine. Hann[10] reported this result, as follows:

> "Bacteriological tests showed that the water [Schuylkill River Water] contained an organism, resistant to chlorine, that formed gas from lactose. Confirmatory tests for Esch. coli were negative. . . With chlorine treatment, 40 per cent of all tubes inoculated showed non-confirmable gas; with ozone, 28 per cent; and with both ozone and chlorine, only 19 per cent."

Hann[11] notes ". . . the virus of infantile paralysis is inactivated."

Color in water, normally due to colloidal organic compounds, may be removed by employing a method to oxidize the organic compounds. Superchlorination and treatment of water with potassium permanganate are two such methods which have been successful. Ozone, being one of the most powerful oxidizing agents, is also effective in removing color, as indicated in table[11] 1.

Table 1—Color Removal With Ozone

Average for Ten Different Waters
Initial Color—27 ppm

Ozone Applied	*Color Removal*
1.0 ppm	8 ppm
2.0	12
3.0	16
4.0	18

Ozone is particularly effective for taste and odor removal. By comparing results of the average threshold odor reduction by ozone pilot plant tests, with the results obtained from city plant treatment at the same location, McLaughlin[12] concludes: ". . . an overall reduction in threshold odor, of approximately eighty percent, may be expected from a combination of ozonation and filtration. This is approximately twenty percent better than that obtained by slow sand filtration or double filtration, and fifty percent better than rapid sand filtration alone."

Chlorine and ozone remove taste and odor by oxidizing the organic compounds in the water; but ozone, unlike chlorine, does not react with the organic compounds to increase taste and odor; therefore, a dose of ozone that is insufficient for complete taste and odor removal merely results, at worst, in inadequate treatment. The taste and odor that remains is described as sweet, flowery, or balsamic. Most persons would not object to such a taste and odor. Apparently, ozone reacts in two ways: (1) removes objectionable taste and odor by oxidizing the organic compounds in water; and (2) "tempers" the taste and odor of organic compounds.

The first cost[11] of an ozone plant may vary from less than $10,000 to as much as $25,000 per mg of water treatment capacity. Electric energy costs, which varies among plants depending upon the desired objective, is the major item in operating expense. Whitson[8] reports electrical energy used for disinfecting purposes in a number of French plants ranges from a low of 45 kwh/mg to a high of 90 kwh/mg. Hann[11] reports ozone plant operating costs, assuming electrical energy is available at $0.01/kwh, as shown in Table 2.

About 9 to 14 kwh of electrical energy are required to produce and apply one pound of ozone. It is interesting to note that on the basis of the heat of reaction only 0.38 kwh is required to produce one

Table 2—Ozone Operating Costs/mg

Primary Objective	Usual Range
Disinfection	$1.00 — $3.00
T & O Reduction	1.00 — 5.00
Color Removal	2.00 — 8.00

pound of ozone. Assuming that the ozone generator uses one-half of the total electrical energy[12] actually expended in producing and applying one pound of ozone (i.e. 4.5 to 7 kwh), the efficiency of the ozone generator is about 5.4 to 8.4 percent.

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Trickling Filter Study

(*Continued from page 76*)

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People, Places & Events

(*Continued from page* 16)

low mineral supplies in the nation." —With this introduction, Atlanta's Water Works is presented in a 16-page booklet by Paul Weir, Gen. Mgr.—This is a neat piece of public relations. I suggest you get a copy of it to compare with your own public relations efforts.

★ ★ ★

Swedefinition — "Loafer — A man who likes to mow the lawn in the winter and shovel snow in the summer."

★ ★ ★

Pardon Me For Pointing—We in this water and sewage works business were all proud and glad to see the dedication, at long last, of the new Sanitary Engineering Research Center of the USPHS at Cincinnati. It is a tribute to the foresight, understanding and perseverance of the many men in the PHS and a monument to their work over the past several decades. With this new research center, we can look to even greater accomplishments.

I heard somewhere that the new lab. is to be called the Robt. A. Taft Sanitary Engineering Center, since Taft sponsored the legislation which established it. I'm all for honoring great men, but—I wish some recognition could also be given to John Hoskins or others so long identified with the Cincinnati Research work of the PHS. Maybe a particular laboratory will be named for "J. K." etc.

★ ★ ★

This year, I had the opportunity to attend the 2nd Conference on Instrumentation at Manhattan College. Brother Joseph McCabe, Head of Civil Engineering and Wes Eckenfelder, Cons. Engr. of Ridgewood, N. J., put on a good show.

I was interested to hear Alex Diachisin of the Interstate Sanita-

tion Commission say that you can't use radioactive tracers for sewage in ocean waters because of the high background count.

Alex also said that determining the Coliform MPN was like trying to pick up a needle with boxing gloves. We need a new indicator organism according to Diachisin.

John Baffa, Cons. Engr. of New York City, talked on instrumentation in stream control. John did a little crystal ball gazing and foresaw quite a future for instrumentation, but it will be a few days before this Utopia arrives.

Virgin Langworthy, Res. Chem of the Chlorine Institute, remarked after the meeting, that all of the speakers at this conference were young men. Every generation has its young men who get in on some developing phase of the business and ride it to success. Is instrumentation the next big advancement in the field of sanitary engineering?—Looks like it.

★ ★ ★

Luminous Quote — "Be not the first by whom the new is tried, nor the last the old to lay aside."—*But*—if no one tried the "new", where would we all be today?

★ ★ ★

News Notes From Brushy Bend—The West Shore Water Producers, a group of water works men who run water departments along the west shore of Lake Michigan, held a spring meeting in Racine, Wis. on April 28. George (The Punster) Prindle, Supt, of Highland Park, Ill., is Secretary.—The Lower Hudson Section of the NYSIWA had its spring meeting at Middletown on May 20. Plant inspection preceded a dinner meeting at the Orange County Golf Club. Menu—Broiled Chicken, $2.50 including tip.—Tom Higgins, Plant Operator, Lederle Labs., is Secretary.

The 20th Spring Conference of the Southern Section of the Illinois Water Plant Operators occurred at Salem, Ill. on May 12. Held at the Globe Theater, the morning program had papers on safety, emergency water supplies, raw water problems, slow sand filters, and tastes and odors. Annual trophies for the best operated plants were presented at the luncheon and inspection trips were held in the afternoon.—Earl McClendon of Benton, Ill., is chairman.

V.T.Y.—Doc Symons

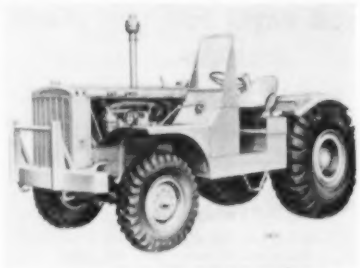
PUBLIC WORKS
EQUIPMENT NEWS

Published Monthly **June, 1954**

Caterpillar Announces New 4-Wheel 150-hp Tractor

A new 150-horsepower four-wheel tractor has been announced by Caterpillar Tractor Co., Peoria, Ill. The new tractor, the DW15, is powered by a Cat six-cylinder D326 diesel engine, producing 150 hp at 1800 rpm. The engine has aluminum alloy pistons with cast in iron band backing for the top compression ring. A triple duty oil pump provides positive lubrication on steep grades. Oil can be picked up from the front or rear of the oil pan or from the main oil sump located near the center of the tractor.

The standard transmission gives double speed ranges, with 10 forward speeds up to 24 miles per hour and two reverse speeds up to 3.3 mph. Optional final drive gears make possible speeds up to 31.3 mph. Large capacity wheel brakes are foot pedal controlled and have compressed air boosters. When brakes are applied, those on the pulled unit are actuated automatically just before the prime mover brakes take hold. This insures anti-



Diesel powered four-wheel tractor introduced recently by Caterpillar

jacknife protection. A comfortable foam rubber seat has an adjustable snubber arrangement which minimizes rebounds and gives greater comfort to the operator. A 75-gallon fuel tank contains enough fuel for a full day of operation. Wheelbase dimension on the DW15 is 121½ inches. Front tire sizes are 12.00 x 20, 14 ply traction type. Rear tires are 21.00x25, 20-ply rock type. Length is 16 ft. 8 ins. For illustrated folder circle No. 6-1 on coupon.

Power Driven Marker Spray Paints Lines For Traffic Control

This power-driven, riding-type line marker will spray paint clean traffic lines on rough surfaces. It has a 10-gallon explosion-proof tank. It is capable of painting 2 to 5 miles of line (2 to 6 in. wide) per hour. Double lines or skip lines can be painted with minor accessories. This model features a patented tank cover with a quick locking device, an adjustable pressure control safety valve on the air receiver, and air actuated spray guns for sharp cut on or off. Guns and lines are easily cleaned and flushed without removal. Controls are located at the handlebars. Complete accessories include bead hopper and dispenser, automatic skip line control, hand type spray guns, agitators, cleaners. Write Universal Manufacturing and Sales Co., 5211 Pacific Blvd., Huntington Park 5, Calif., or circle No. 6-2 on the coupon.

Basic Unit with Attachments Will Dig, Sweep, Bulldoze, Lift, Roll and Mow

Eleven attachments are available to go with the one basic unit, the Davis Pit-Bull, which fits all Ford and Ferguson tractors. The eleven attachments include a ⅝-yd. bucket; a backhoe that digs 10½ ft. deep; a trencher that cuts to a depth of 5 ft.; a 8-ft. rotary broom; a 72-inch bulldozer blade; a swinging crane; a 45-inch roller that gives a compression of 100 psi; a rotary mower which pivots for side mowing; a lift fork with a capacity of 2500 lbs.; a 350-lb. hammer; and a 5-ft. auger. All eleven of the attachments are hydraulically operated and because they have been designed simultaneously with the basic unit, they fit to close tolerances for easy hook-up. With this equipment, the machine and its one operator can be kept busy all of the time on the multitudinous jobs in every city and county. An excellent booklet is

Attachments for Davis Pit-Bull are shown in these three action photos

Sturdy ⅝-yd. bucket loader lifts to 105". Trencher is shown at the left

All attachments fit basic hydraulic unit. This is the 8-ft. rotary broom

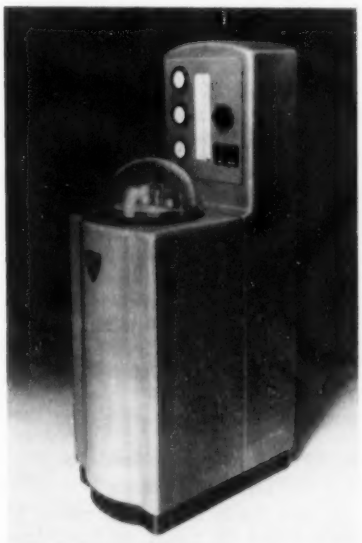
available. Write Mid-Western Industries, Inc., 1009 South West St., Wichita, Kans., or circle No. 6-3 on the coupon.

Two-Way Radio Operates on Both 6 and 12-Volt Systems

These new Motorola two-way radios operate interchangeably on either 6 or 12-volt automotive electrical systems without any circuit modification. This assures the maximum flexibility in radio-equipped fleets having vehicles with both 6 and 12-volt systems. Models are available for either under-the-dash mounting or for trunk locations, with 144-174 mc and 10 and 25 watts. More from Motorola Communications and Electronics, Inc., 4545 W. Augusta Blvd., Chicago, Ill., or circle No. 6-4 on the coupon.

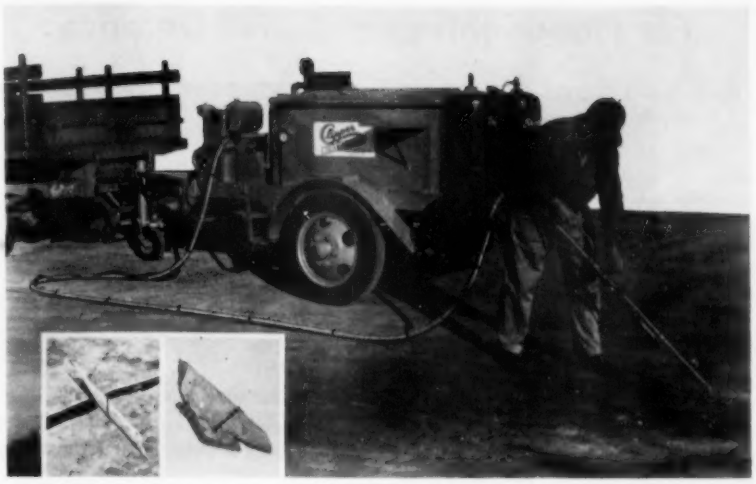
W & T Chlorinator Has Many Improved Features

A new chlorinator, the A-701, was introduced by Wallace & Tiernan, Inc., Belleville, N. J., at the AWWA convention in Seattle last month. Announced as the first of a series that incorporates latest chlorinator developments, it features such improvements as a dual orifice meter



Streamlined W&T A-701 chlorinator features several new developments

which automatically, or manually, allows feed ranges up to 100:1; the use of corrosion resistant materials; linear reading of chlorine flow rate; and automatic, electric, hydraulic, air or vacuum control. Maximum capacity is 1,000 lbs. in 24 hours. More on this new machine from the manufacturer or circle No. 6-5 on the coupon.



Sawed contraction joints are completely filled with this pressure joint sealer

Sealing Two Miles of Contraction Joint in a Day

A Clipper joint sealer was used to fill completely a ⅛-inch sawed contraction joint at the Carswell Air Base, Fort Worth, Texas. The contractors on this job, Nolan Bros., Inc., have demonstrated some startling advantages of this method. In a normal working day, the Clipper joint sealer will seal approximately two miles of sawed contraction joints of any width, averaging 1250 ft. an hour. There is a minimum of waste material, no matter what kind of joint compound is used. The kettle, by American Steel Works, has a capacity of 165 gals., with a melting production rate of 40 gals. per hr. Nozzles are of special alloy. There are many other outstanding features. Write Clipper Mfg. Co., 2800 Warwick Blvd., Kansas City, Mo., or circle No. 6-6 on the coupon.

Heavy-Duty Wheel-Type Ditcher Digs to 40 Ins. Wide

This ditcher is suited for digging for storm or sanitary sewers, water mains, conduits and cables, building foundation and footings and cross-country pipe lines. It is of the wheel type and will cut to a maximum depth of 6 ft., and from 24 to 40 ins. wide, in 2-inch steps. There are 8 digging speeds forward. Wheel rims are drilled for 15 standard buckets, but 8, 10 or 12 may be attached. Flat-bottom buckets are available. Spoil can be deposited on either side of the trench. For more data on this Model 315 Buckeye, write Gar Wood Industries, Inc., Wayne, Michigan, or circle No. 6-7 on the coupon.

Finding Buried Pipes and Conduits Faster

That "electronic witch" we spoke about last month is now the subject of a news release. It is claimed to have greatly improved operational and overall field performance in the location of pipes, conduits and other buried metals. An added feature is the fluid leak detector circuit which permits using this equipment as an emergency leak locator. The case is of fiberglas; there is a completely new type of electronic circuit. More detailed data from Fisher Research Laboratory, Inc., Palo Alto, Calif., or circle No. 6-8 on the coupon.

Outside interference is reduced in Electronic Witch M-Scope pipe finder

For Floodlighting and Civil Defense

Easily Carried Generators Provide Power for Emergency Service

Either AC or DC power is available in these light weight, easily portable, engine generator sets. The F2500 delivers 2500 watts of DC and weighs only 148 lbs.; the F3000, with 2000 watts continuous capacity, has a starting capacity of 3000 watts AC and also weighs 148 lbs. Both furnish 115-volt current. They will operate portable power tools, provide floodlighting and fill CD needs. More from Wincharger Corp., Sioux City, Ia., or circle No. 6-9 on the coupon.

Wincharger Engine-Generator, Model F2500. Unit weighs only 148 pounds

"Commercial Mixer" bituminous mixing unit. This self-contained highly-portable twin-shaft unit, Model CM, has been designed for patching, surfacing parking lots, driveways, alleys, school yards, tennis courts, etc. The rated capacity is approximately 40 tons per hour, depending on the type of mix, specified mixing time and capacity of drying and feeding time. Material is fed into the drier from a two-compartment hopper, adjustable bin gates proportioning the aggregate according to specifications. The enclosed bucket elevator delivers multiple hot mix aggregate to the mixer. The bucket elevator can also be arranged for cold mix applications or to use a weight calibrated apron feeder on the mixing unit for single aggregate hot mix. Iowa Manufacturing Co., Cedar Rapids, Iowa.

A heavy duty pipe cutter is announced by Toledo Pipe Threading Machine Co., Toledo, Ohio. This cutter is of the wheel and roller type, capacity ⅛ inch to 2 inch pipe. Other features include simple modern design; it hooks on the pipe easily and tracks perfectly; the malleable frame is formed to fit the hand and is guaranteed warp-proof. The high alloy steel cutter wheels leave practically no burr.

Cuts 12-Foot Contraction Joint in Half a Minute

Sawing contraction joints and thus speeding up highway construction is the job of this machine. Operating from a controlled power driven carriage, and equipped with diamond blades, the machine will cut a 12-ft. joint in as little as 30 seconds, making straight cuts of uniform depth. Cuts can be from a fraction of an inch to 6 inches deep. Ability to pour continuous slabs and let the concrete set saves construction money, the joints being cut later. There are three Kohler engines to drive the cutter blades and the three-stage hydraulic pump. For more information on this money-saving cutter write Felker Mfg. Co., Torrence, Calif., or circle No. 6-10 on the coupon.

Contraction joint cutter developed by Felker speeds highway construction work

Panel Design of Steel Building Cuts Erection Costs

There are many uses for steel buildings. The "Panl-Frame" unit announced by Butler, is said to permit faster erection, reducing time and labor. Panels can be bolted together inside and then taken out for field erection, allowing the work to go on regardless of weather conditions. This building is available in widths of 4 to 16 ft., with 8 or 10-ft. wall height. There is unusual freedom in window locations, and door construction provides new advantages. More from Butler Mfg. Co., 7400 E 13th St., Kansas City 3E, Mo., or circle No. 6-11 on the coupon.

Side elevation of low-cost building showing new Panl-Frame construction

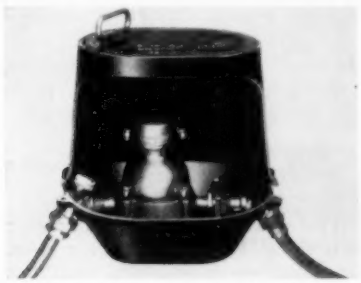
The new gripping dog, developed by The Trojan Mfg. Co. for use on their Model B Pipe Puller and Pusher, increases the life of the dog four times and cuts maintenance costs correspondingly. This machine will install or renew pipe under pavement without breaking the surface, push or pull pipe up to 2" in diameter without additional dogs, clamps or edges, and requires only a 5½-ft. trench. All inserts are interchangeable, thus eliminating the necessity of buying a complete new dog. The weight is 140 lbs. Trojan Mfg. Co., 1203 Race Drive, Troy, Ohio.

Plastic Sign is Said to "Last a Lifetime"

A sign made of plastic, which is claimed not to break or rust, has been introduced jointly by General Tire & Rubber Co. and Municipal Street Sign Co., Inc., 777 Meeker Ave., Brooklyn 22, N. Y. These "Sy-Loy" signs are reinforced with fiberglas fused with polyester resins and pigments, are flexible and return always to the original shape. Made in all sizes with standard legends and in various colors. Illustrated brochure from Municipal Street Sign Co. at the above address, or circle No. 6-12 on the coupon.

A Meter Housing Especially for Warm Climates

This is the "Yokebox," a new cast iron meter housing for shallow or warm climate settings. It is simple, consisting of a bottom pan with fittings, a slightly tapered oval shaped cylindrical housing and a lid. The pan, which has holes to permit drainage, is set about a foot below the ground surface, and the remainder of the installation then made. Advantages claimed are: The meter is completely housed and protected from mechanical damage; the meter is easily removed or replaced without disturbing the service line; it is easy to read; and removal of the meter and expansion connections prevents connecting across to steal



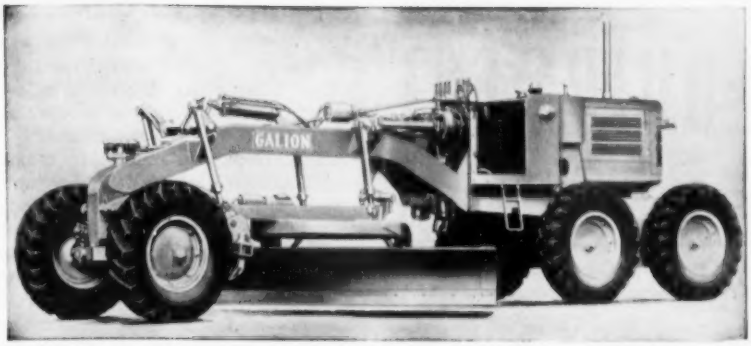
Cast iron Yokebox meter housing developed by Ford for warm climate use

water. More on this interesting device from Ford Meter Box Co., Wabash, Ind., or circle No. 6-13 on the coupon.

New Machine Speeds Up Mulching

This machine was recently built for the Lane Construction Company, Meriden, Conn. by the Papec Machine Company, Shortsville, New York. The Lane Company was dissatisfied with the results they were getting when mulching new seeding by hand. Labor costs were excessive and the hand mulching lacked uniformity.

A standard Model 181 Papec Forage Harvester was adapted to suit the Lane Company's specifications. Powered by its own engine, the mulcher is towed behind a truck carrying the mulching material. Two men on the truck open the bales and toss the material onto the feed table of the machine, which chops it and blows it over the seeding. A third man rides at the back of the mulcher and swings the delivery pipe back and forth to direct the spread of the chopped material. The Lane Company reports that it has proved very satisfactory. More from Papec or circle No. 6-14 on the coupon.



Galion Model 450 all-gear tandem drive motor grader for medium heavy duty

Galion Has New Medium Heavy Duty Tandem Grader

The weight of this fine new machine is in excess of 20,000 lbs., and it has a 75 hp IHC diesel engine and a constant mesh transmission with six overlapping forward speeds, 1.1 to 20.1 mph. Drive is 4-wheel, positive. Tires are large, low pressure. Steering is by hand with hydraulic booster, and all blading and scarifying operations are under full hydraulic control. This grader has a full circle reverse and a 90° bank cutting angle. Also some extras are available. Full information from Galion Iron Works & Mfg. Co., Galion, O., or circle No. 6-15 on the coupon.

You Will Find Many Jobs for this Loader-Excavator

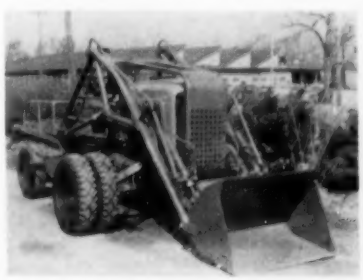
Dempster-Diggster excavator shovel and loader is hydraulically powered

The new Dempster-Diggster GRD-101 is an excavator shovel and front end loader that is operated by hydraulic power with independent crowd and hoist action. Features are: Truck-speed mobility to and from jobs; maximum dumping and digging height; minimum turning radius through tricycle steering; an automatic bucket trip; and hydraulic steering. No wheel traction is needed to get excavation power. Full information from Dempster Bros., Inc., Dempster Bldg., Knoxville 17, Tenn., or circle No. 6-16 on the coupon.

Heavy Duty Industrial Backhoe for Crawler Tractors

Heavy duty industrial backhoes are now in production by Ottawa Steel Products Co., Ottawa, Kans. These units have an extended reach of about 15 ft. and will dig below the 9-ft. depth. They are mounted on crawler tractors for all-around rugged use. More from the manufacturer or circle No. 6-17 on the coupon.

Front end loader and snow plow. This new attachment, a front end loader with a 1/3 yard bucket and snow plow, can be quickly and easily attached to the Worthington model "F" tractor. The design of the tractor, with front wheel drive and rear wheel steering, makes it especially adaptable for use with this attachment. A plow-blade is interchangeable with the bucket. It can be used for sand, gravel, snow, loose dirt, etc. Worthington Mower Co., Stroudsburg, Pa.



Front end loader or snow plow attachment used with Worthington tractor

Flocculation for Conventional Water Treatment Plants

Designed for vertical mounting in the flocculation basin, this new "Spirol-Mix" equipment is especially suited for use in conventional-type water treatment plants. It consists of a variable-speed drive on top of the basin which is connected by a flexible coupling to a paddle-type mixer. Water entering at the bottom is gently roll-mixed as it passes upward. The pitch of each set of diagonal blades is slightly increased toward the central axis, assuring uniform water motion. It is claimed that this mixer eliminates short-circuiting, prevents break-up of floc and produces a uniform motion over the entire area of the basin. More information from Graver Water Conditioning Co., New York, N. Y., or circle No. 6-18 on the coupon.

The Ridgid portable power drive for threading, cutting and reaming pipe with hand tools is now made with a new wrenchless Speed-Grip Chuck, developed by The Ridge Tool Co., Elyria, Ohio. It is claimed to operate on a different principle from conventional hammer chucks, guaranteeing to hold any kind of pipe or rod securely both forward and reverse. To operate, grip-tooth jaws are closed by a hand wheel and socked lightly. This tool handles ⅛ to 2 inch pipe, ¼ to 2 inch bolts.

Vibratory Compactors Handle Many Jobs

One Man Operates Unit for Patching, Compacting Trenches and Fills

This is a one-man operated unit consisting of two standard Jackson vibrators with 26-inch bases. Bases are interchangeable to provide widths of 12 to 26 ins. The vibrators

Manually guided vibratory compactor in use on blacktop street patching

are self-propelling and are especially suited for such work as compacting trenches as narrow as 12 ins.; compacting subbases for floors, fills, walks and shoulders; for compacting pavement patches; for placing and compacting small sections of pavement; and for doing many other jobs of the same nature. It is claimed that maximum density of blacktop or granular soils at optimum moisture can be accomplished at the rate of 2400 sq. ft. per hour. The units are driven by a trailer-mounted power plant, making the entire unit easy to move from place to place. Write Jackson Vibrators, Inc., Ludington, Mich., or circle No. 6-19 on the coupon.

Multiple Unit Compacts Macadam and Widening Strips

This multiple vibratory compactor will do a lot of compacting jobs. On macadam base work, one pass of the compactor will compact 12 ins. of stone enough to support smooth rollers; and four passes will compact to final density. In gravel subbase work, two passes will compact to more than 100 percent of Standard Proctor. For compacting widening strips, the machine is hauled at the side of a tractor, compacting the strip in one pass. It is also recommended for granular soil fills, as for bridge approaches for which it is especially adaptable because of its mobility. Working speeds are to 60 fpm; standard width is 13 ft. 6 ins., but separate units can be removed to meet narrower working conditions. Many other interesting features. Write Jackson Vibrators, Inc., Ludington, Mich., or circle No. 6-20 on the coupon.

Multiple compactor unit compacting sand fill on approach of a bridge

New Portable Power Saw Features Reciprocating Blade

High speed cutting, light weight, safe operation and easy maintenance are a few of the many special features of the gasoline-powered Wright saw, which uses a single guided reciprocating sawblade. The design provides vibrationless, dynamic balance with a twin cylinder, single firing engine which gives blade speeds up to 160 strokes per minute. Cuts may be made in all positions; no swiveling is required. Safety features include the guarded blade which faces down and away from the operator, and automatic shut-off when the trigger is accidentally released. To reduce operator fatigue, liberal use is made of lightweight, high-strength alloys with the result that the machine

Wright power saw features reciprocating sawblade which is guided and protected by the fixed blade guard

weighs less than 25 pounds. Fast cutting speeds and precision operation are made possible by the guided alloy-steel sawblade which cuts an extra-narrow kerf, less than 3/16" wide. Single cuts may be made 18" long; trees 36" in diameter may be felled with this machine. Full information on this exclusive power sawing method is available from Wright Power Saw and Tool Corp., 292 Longbrook Ave., Stratford, Conn. Check No. 6-21 on the coupon.

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Assistantships in Sanitary Engineering at UNC

A graduate assistantship in sanitary engineering is open for two academic years at $925 for the first and $1100 for the second year. There are also openings for several half-time research assistants for two academic years at $1600 per year. Full information can be obtained from Department of Sanitary Engineering, School of Public Health, University of North Carolina, Chapel Hill, N. C. Write direct and include data on training and experience.

INDEX OF ADVERTISEMENTS

● **Philadelphia's new** $9,000,000 Air Terminal Building has every modern convenience, including electric arrival and departure announcement boards and a way for incoming passengers to get their baggage within ten minutes. Airways Engineering Corporation of Washington designed it, with Carroll, Grisdale & Van Alen of Philadelphia associate architects. Apparently Philadelphia has taken a lesson from the book of other cities who underestimated the future of air travel. Photo by Alfred A. De Lardi, F.P.S.A.

—Worth Seeing

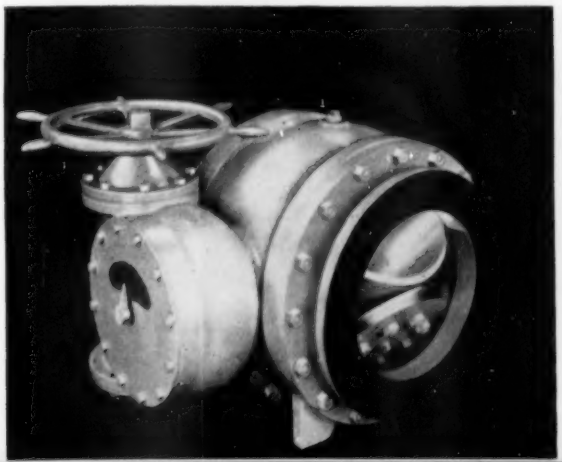
● **This Gledhill** Road Machinery Company tandem drawn Earth Mower is announced as the latest power and time saver on such jobs, which is also money. All are hydraulically controlled by the contractor operator in speeding jobs.

"It's only 8 o'clock in the morning in this country yet."—Algernon Blair.

● **Part of a fleet** of 50 special Gar Wood Load-Packers ordered by the City of Chicago lined up at Gar Wood Industries, Inc., Wayne Michigan, plant. Haul-away drivers are making preparations for delivery.

● **The 5,000th** Lorain "TL" light-duty Moto-Crane is shown here all decked with banners which bespeak The Thew Shovel Company's justified pride in their line.

● **If you were** at the Seattle A.W.W.A. Convention last month you saw this big new S. Morgan Smith Company ball valve "in person." Here is a pictorial reminder.



WORTH TELLING

by Arthur K. Akers

★ Aeroil Products Company, Inc., South Hackensack, N. J., will be represented in Oregon and western Washington by Nelson Equipment Company, Portland. They occupy a new and modern building there.

★ Louis B. Neumiller culminates a life-long connection with Caterpillar

Mr. Neumiller

Mr. Eberhard

Tractor Company by becoming chairman of its board. Harmon S. Eberhard succeeds him as president.

★ Harry M. Durning is elected chairman of the board of The Permutit Company, New York. He was formerly collector of customs for the Port of New York.

★ Fairbanks, Morse & Company invited our editors to something new and needed in this country. It was a forum held in May in connection with a four-day ceremony signalizing the opening of F.M.'s new Kansas City, Kans., plant. It was titled A Technical Forum on Problems Arising from the Increased Use of Water in the United States. A dozen authorities from the fields of hydraulics and education participated. Demonstrations included one of a 116-inch pump for controlling the water in the Everglades of Florida.

★ Pacific Flush Tank Company names Harry E. Schlenz, president; and Lawrence E. Langdon, vice president and sales manager. Lester E. Rein moves up from president to the new office of chairman of the board.

★ All of Galion Allsteel Body Company sales west of the Mississippi will now be under the direction of Leo M. Brown, headquartering at their Galion, Ohio, works. Another Ohio State alumnus, by the way.

★ Five Worthington engines and thirty Worthington pumps go into the new Miami sewage treatment plant, one of Metcalf and Eddy's king-sized jobs.

★ Robert L. Riker is appointed assistant to President Martens H. Isenberg of Combustion Engineering, Inc., of New York. He continues supervision of the Proposition department as well.

★ Ralph Winslow, manager of Koppers Company, Inc., department of public relations since 1947, has been given vice presidential title and stature.

★ Wald Industries, Huntingdon, Pa., announces Robert S. Holmes as executive assistant to President Armand E. Keeley. Bob is a Tennessean and a "rambling wreck from Georgia Tech" ('38) so we know he's good!

Mr. Walker

★ Birmingham gains a new industry and citizen, too, in Max G. Walker, southeastern sales manager for Hammond Iron Works plant there. Hammond specializes in tanks and steel plate structures and Mr. Walker is well known in that field. He is an alumnus of Ohio State and the U. S. Navy.

★ The ASHEVILLE (N.C.) CITIZEN gives an explanation of the power of the new H-bomb in terms which we can understand. "It's roughly the force of three 5-year olds confined to the living room on a rainy Saturday."

● Installing a 30" Lock Joint distribution line in a tight spot in the streets of Richmond, Va.

LOCK JOINT

the ideal pressure pipe for distribution systems...

New modern equipment, which permits the easy tapping of concrete pipe, has brought about a great demand for Lock Joint Concrete Pressure Pipe in water distribution systems.

Because of its extremely long life and low maintenance requirements, Lock Joint Pipe is ideally suited for this purpose. Its smooth concrete walls assure permanent high capacity without periodic cleaning, and its conservative design gives maximum safety in congested areas where pipe line failure spells disaster and even minor repairs are difficult and costly.

If your pipe project calls for pressure pipe 16" in diameter or larger, specify Lock Joint, the trouble-free answer to your pressure pipe requirements.

For many years one of the leading producers of sewer, culvert and water supply pipe, Lock Joint also manufactures pressure pipe for:

INDUSTRIAL INSTALLATIONS (Supply, circulating and cooling systems)

SUBAQUEOUS INSTALLATIONS (Water intakes, siphons and sewer outfalls)

WATER WORKS OPERATIONS (Pumping and treatment plant piping)

SEWER WORKS OPERATIONS (Sewer force mains and treatment plant piping)

LOCK JOINT PIPE COMPANY

Established 1905

P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich., Columbia, S. C.

SEWER & CULVERT PIPE PLANTS:

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NOW DEPENDABLE CHLORINATION plus

Since 1913, Wallace & Tiernan has consistently offered the best in chlorination and chlorination equipment. Now . . . the new A-701, first of the W & T "700" series of chlorinators, and the most up-to-date chlorinator available today, offers these PLUS VALUES to assure safe and dependable chlorination:

- *Feed ranges up to 100 to 1 without replacing meters.*
- *Maximum corrosion resistance without sacrifice of structural design.*
- *Linear scale reading of chlorine flow rate.*
- *May be operated by manual control, or automatically by electric, hydraulic, air pressure or air vacuum control.*
- *Feed rates up to 1000 pounds per 24 hours.*

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